MINING CONGRESS JOURNAL

Pressure-treated Timber Pays for Itself in Labor Costs

A recent report of the Coal Division of the American Mining Congress stated: *"Under the existing wage contracts and with time and a half for overtime, the actual cost of 'spot' tie renewals is an item worth real study. Under varying conditions in many mines the average 'spot' tie renewals in main haulage tracks studied varies from 12 to 25 ties for two men in one seven-hour shift."*

Tipples...Piling...Guard Rails...Fences...Poles...Buildings, Bins, Sheds...Piers, Docks, Wharves...Platforms...Flooring...Tanks, Sumps, Vats...Crossing Plank...Barge Sides and Bottoms...Cable Ways...Conduit...Culverts...Flumes...Trench lining and covers...Conveyor Decking and Supports

●

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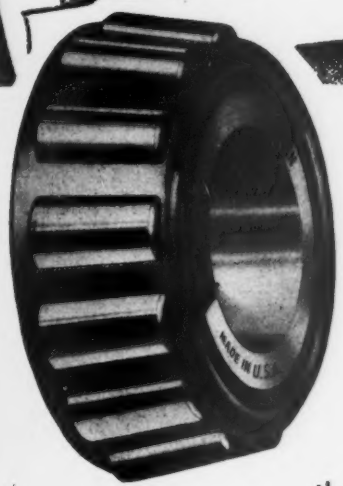
BIG NEWS FOR OPERATORS OF SMALL MINE CARS



Operators of small mine cars can now afford the advantages of TIMKEN Bearings. As a result of recent developments we have found that certain sizes of TIMKEN Bearings, regularly produced in large quantities for automotive and industrial uses, are suitable for service in small mine cars of *one* to *two ton* capacity. A number of mine cars equipped with these bearings have been used for some time with highly satisfactory results.

TIMKEN Rock Bits eliminate forging, drill faster, last longer and cut drilling costs wherever they are used.

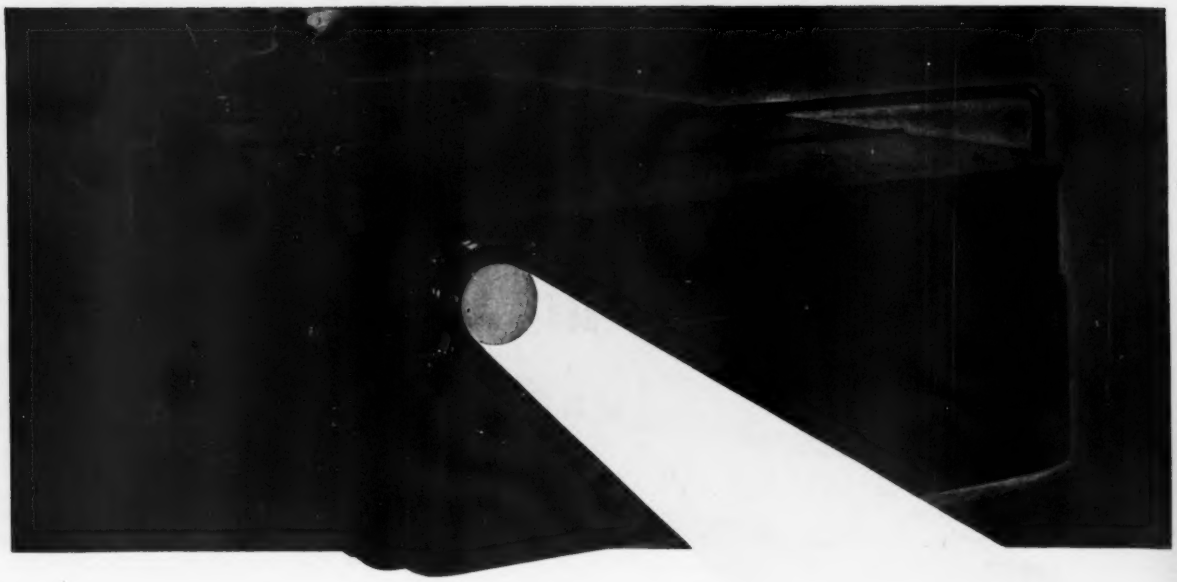
The economies resulting from our large production of these sizes of bearings are passed on to the operator. In view of this fact operators of small mine cars can no longer continue using plain bearing equipped cars with the resulting losses of power waste, grease leakage and axle wear.

For further information consult your car builder or our engineers.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

TIMKEN
TAPERED ROLLER BEARINGS



NEW EYES *for Mine Locomotives*

"Let there be light!" said O-B illumination engineers. And so were born four new and improved incandescent mine locomotive headlights—sturdy, mine-bred headlights—offering better illumination at lower operating and maintenance costs. And here they are:

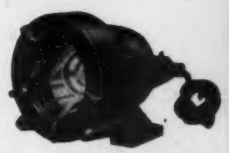
NEW MF PERMISSIBLE GAS-PROOF HEADLIGHT-
available in two types: 1. Pre-focus type. 2. Push-pull focus type.

NEW MS AND MSS TYPES FOR MAIN HAULAGE-
available in three types: 1. Pre-focus type. 2. Push-pull focus type. 3. Externally-operated focus type.

NEW MB TYPE FOR GATHERING HAULAGE-
available in three types: 1. Pre-focus type. 2. Push-pull focus type. 3. Externally-operated focus type.

Supplementing these headlight developments are new spring-cushioned porcelain tube resistances for the MS, MSS and MB and an explosion-proof resistance for the MF. Complete catalog and descriptive information on O-B incandescent headlights and accessories is contained in the new O-B Mine Headlight Catalog Booklet. Send in the coupon or ask your O-B salesman for your copy now.

NEW MF



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Pumps driven by G-E motors kept the water pouring out of the mine at more than 4000 gallons per minute. Because of the high acid content of the water, pump parts that came into contact with it had to be covered with rubber

3,000,000,000 GALLONS OF WATER

Pumped from Flooded Mine

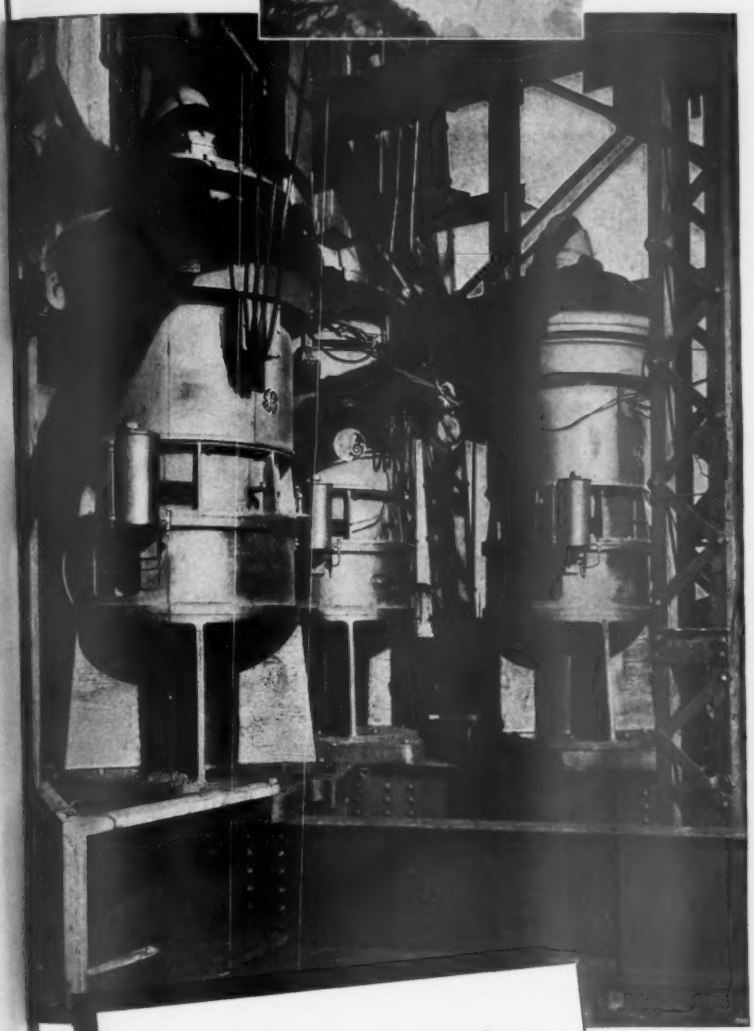
G-E VERTICAL HOLLOW-SHAFT MOTORS MEET THE REQUIREMENTS

THE Oliver Mine No. 3 of the Commodore Coal and Coke Company and adjacent mines in the Pennsylvania bituminous region have been drained—drained of more than 3,000,000,000 gallons of water that since the flood of 1936—and until a few months ago—had made them a veritable underground lake.

G-E MOTORS ON THE PUMPS

Deep-well turbine pumps equipped with General Electric 600-hp vertical hollow-shaft motors removed the water efficiently and without trouble.

These motors were among the largest of their type that had ever been built. Each required a specially designed thrust bearing capable of supporting 32,000 pounds of rotating parts and hydraulic load. Their highly successful operation reflects the skill with which G-E engineers met this and other requirements.



G-E 600-hp, 1170-rpm, 2300-volt, vertical hollow-shaft motors driving Sterling deep-well turbine pumps at headframe of Oliver Mine No. 3 of the Commodore Coal and Coke Co., near Uniontown, Pa.

SPECIFY G-E

This outstanding example of electrical application shows the wisdom of specifying G-E motors and control for your mining equipment. You can be sure of getting electric equipment that is not only dependable but also suited exactly to the driven machine. For information about General Electric's complete line of electric equipment for mining service, just get in touch with the nearest G-E representative. General Electric, Schenectady, New York.

Their performance on mine-drainage project again shows that G-E engineering assures dependable, efficient operation.

General Electric's complete line of electric equipment for mining service includes:

Motors
Control
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35-BC SHORTWALL | 35-B SHORTWALL | 35-20 SHORTWALL | 24-B LONGWALL

A COMPLETE LINE OF CUTTERS

THE MOST FOR YOUR MONEY

As an out-and-out business proposition the big job in coal mining is not to produce tons, but to make each ton pay. Which means you've got to get the most for each equipment dollar . . . both in first cost and from operating economy.

Jeffrey coal cutters are a sound investment no matter how you take it. They are safe machines, of practical time-tested design. By gradual development, which insures genuine utility and reasonable first cost, they have been kept up to desired standards of performance. No cutter will cut more coal, or at less cost, than a Jeffrey cutter.

Still other reasons make Jeffrey cutters a safe long-time investment. Their depreciation is less because they are built simple and rugged, to stand up. Their long-time profitable usefulness is assured because Jeffrey has managed to stay years ahead in practical design—It pays to use Jeffrey cutters. The Jeffrey Manufacturing Co., Columbus, Ohio.

Jeffrey

Track Type Machine—"Pat. and Pats. Pending—also licensed under the patents of E. C. Morgan." Patents Numbers 1,706,961, 1,706,962, 1,707,132, 1,707,133, 1,953,325, 1,953,326.

A MACHINE FOR EVERY CONDITION

35-L LOW VEIN | 35-BB SHORTWALL | 24-L LONGWALL | 29-U UNIVERSAL

MINING CONGRESS JOURNAL

Vol. 24 JULY, 1938 No. 7

CONTENTS—ANNUAL MANUFACTURERS' NUMBER

Opinions expressed by authors within these pages are their own, and do not necessarily represent those of the American Mining Congress

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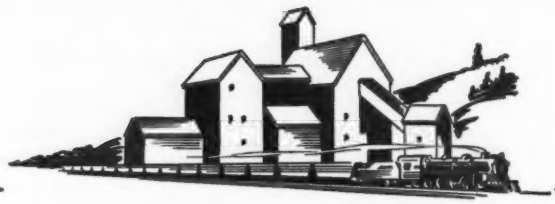
THE AMERICAN MINING CONGRESS
309 Munsey Bldg., Washington, D. C.



Law By Constitutional Amendments

THERE is a growing tendency in the United States toward the making of laws by constitutional amendment. This tendency both in the States and in the Nation, when carried beyond its proper field, contravenes the principles of representative government, and is in accord with those who think they believe in a pure democracy. These seem to ignore the fact that a hundred million people can not possibly concentrate their best judgment into a crystallized law except through representatives authorized to compromise conflicting views.

If laws are to be made by the voters directly, we should at once abolish our present form of representative government, our Congress and our State Legislatures. The saving to be thus effected would be a welcome aid to our National and State treasuries, most of which are at wits end to devise new forms of taxation through which to pay, not deficits but new forms of proposed expenditures. The extent of this saving may be estimated from the fact that it costs a quarter of a million dollars in mileage fees to adjourn Congress for 10 days.

Our forefathers planned for themselves and for us a form of government which to them, and to most people today, seemed best designed to permit each citizen to exert his influence in public affairs by voting for or against representatives, who, in turn, could express in a legislative body the best judgment of the majority of voters in that particular political division of our Nation or State. This plan was embodied first in our Federal Constitution, and later in the constitutions of each of the several States.

The Constitution was the plan of government. It should be assumed that the most important governmental questions were included in the first charter of government and that our Constitution, our charter for government, our chart of government, was so drawn as to cover fundamentals, and that any specific provisions of law could be best left to the law-making power to enact. This would bring laws under the Constitution more nearly responsive to current public demand than if those rules were made a part of the Constitution and repealable only after a long tedious process purposely and properly designed to prevent frequent changes in the fundamental law.

A history of laws made by constitutional amendments will prove the dangers which follow this system and the too frequent necessity for costly repeals of unwise constitutional amendments. The Constitution is not law. It is the foundation upon which—the authority by which—we are able to make laws.

Under a Constitution laws embodying the current desires of the voters can be enacted by the representatives of the people elected upon platforms embodying the principles of the several political parties, each trying to bring about the conditions which that organization of voters seeks to accomplish.

Experience has shown that the two party system is most likely to result in the adoption of more of the principles desired than where smaller groups forming additional political parties present so many proposals that perchance no separate proposal would receive a majority vote.

Two political parties almost equal in voting power create the conditions under which the independent voter may most easily accomplish the best result by voting for the party whose platform best meets his demands.

A JOURNAL FOR THE ENTIRE MINING INDUSTRY—PUBLISHED BY THE AMERICAN MINING CONGRESS

MINING CONGRESS JOURNAL

Vol. 24 JULY, 1938 No. 7

Richard J. Lund, Editor

PRODUCTIVITY, PRODUCTION AND EMPLOYMENT

FOR over two years a large group of research workers in the WPA, in conjunction with experts in various Government agencies, have been engaged in a thorough study of the influence of changes in industrial techniques on employment and unemployment in various industries, particularly in recent years. A sizable staff has been engaged in collecting data regarding the mineral industries, working in conjunction with the U. S. Bureau of Mines.

A recent report on this project, entitled "Summary of Findings to Date—March, 1938," contains information of more than passing concern to the mining industry. Summaries of the work are given for Pennsylvania anthracite, bituminous coal, fuel efficiency, petroleum and natural gas, crushed stone, copper, iron, lead and zinc, phosphate rock and gypsum.

Salient statistics of employment and productivity (production per man shift or man hour) are presented in most instances, but detailed data must await publication of individual reports for each industry that are promised later.

Typical of the tentative conclusions reached is the following concerning copper mining:

> It is estimated that with production depending on the domestic market and increasing to 22 pounds per capita by 1946, the industry is likely to provide employment to 23,800 men, employed 300 days at 8 hours per day; on the basis of a 6-hour shift the number of men employed is likely to be 31,700. These estimates represent a drop of 37 percent in man-days of employment from the 1929 level.

Naturally, the findings show varying degrees of increasing productivity for different mineral industries. In these instances it is aptly pointed out and emphasized that inasmuch as there is a constant increase in natural difficulties connected with mining (necessity of going to greater depths, mining lower grade material or less accessible deposits, to name only a few), any net increase in productivity reflects an even greater advance in mining techniques and efficiency than is immediately apparent.

Mechanization comes in for its share of discussion—and properly so, since developments in machinery have played such an important part in shaping the general character of mining operations during the past couple of decades.

It is heartening to note, however, that consideration is given to the fact that machinery, while admittedly displacing a certain amount of labor, has enabled many of the mineral industries to maintain a goodly portion, at least, of their competitive positions against the inroads of substitute commodities, in the production of which a much smaller amount of labor may be necessary. This is strikingly true in the case of bituminous coal, concerning which the report states:

> Against the direct displacement of labor by the machine must be set the improvement in the competitive position of the industry as against oil and gas, which improvement works to increase sales and employment.

It is to be greatly hoped that this particular phase of the problem will be given even greater attention and emphasis in future reports.

In the words of G. B. Southward, of the American Mining Congress, speaking before the meeting of the Monongahela Valley Mining Institute on June 14:

> Coal mining for its own protection is forced to keep up with the pace set by competing fuels and as a consequence, loading machines, conveyors, improved types of cutting machines and haulage locomotives, mechanical cleaning, etc., are designed and adopted for one purpose only—in order that coal may retain its place as the principal source of power. If hand methods had been able to meet this competition, there would never have been any modern mechanization introduced underground because it is an evident fact that coal operators are not buying machines for the pleasure of watching the wheels go round.

This entire subject ties in closely with the feature articles of this issue, prepared by the manufacturers, themselves, of mining supplies and equipment. These aim to show the cooperative role played by the manufacturers in developing improved mining methods whereby continued operations can be maintained in the face of increased physical difficulties of mining, and the industry may meet the challenge of competitive commodities.

IMPROVED MINING TECHNIQUES Overcome Increasing Natural Handicaps

Presented by | Allis-Chalmers Mfg. Co.
Westinghouse Electric & Mfg. Co.
General Electric Co.

Important Role of SPECIAL ALLOYS

By MAX W. BABB
President
Allis-Chalmers Mfg. Co.

CREATIVE engineering of a high degree has marked the progress of the mining industry, which in itself is a major consumer of mining products. Constant research and development must necessarily be an integral part of any industrial enterprise to provide improved technique and more efficient equipment to cope with increasing natural handicaps.

The mining industry is facing problems today which some years ago could be, or were, overlooked. While a rich ore may be successfully worked with minor regard for operating costs, low grade ores demand that close attention be paid to all factors affecting both mining and refining expenses.

The natural difficulties caused mainly by the depletion of richer ore bodies, greater depths, lower grade and thinner deposits have brought the mining industry face to face with economic problems which must be solved for continued working of existing mines at a profit.

In many cases it has been found advantageous to install machinery of comparatively high initial cost. This increased cost is offset by the use of alloys and specially treated steels to reduce weight, improve strength, and raise the volume of the pay load without appreciable increase in the size of the equipment.

For example, in several installations existing hoisting machinery was found inadequate to handle the rope pull at the drum resulting from the necessity of having to go to greater depth than anticipated when the equipment was installed.

An interesting development along this line was recently encountered at a prominent mine in Mexico. The hoist in question was a double drum type driven by direct current motor supported from an equalizing motor generator set. The maximum capacity of this equipment limited the hoisting depth to approximately 2,200 ft., which at the time of purchase of the equipment was estimated as the ultimate requirement.

In the meantime, development of the mine indicated the ore body extended much deeper and that it would be necessary to hoist from at least 3,000 ft. depth. To scrap the existing equipment was out of the question, and to rebuild the hoist would not only be very expensive but would interrupt output for a considerable period while alterations were being made. No reduction was contemplated in the weight of ore per trip, or daily tonnage output of the mine, when hoisting from the increased depth.

Alloys Permitted Necessary Reduction of Skip and Cage Weight

Since the rope pull at the drum could not be increased, any additional hoisting depth had to be obtained by compensating for the weight of the additional rope by decreasing the weight of the combined skip and cage without reducing their carrying capacity. Research and investigation of new alloys was made and resulted in finding a high tensile steel alloy from which they could be fabricated, and the use of this material reduced weight about 30 percent, or sufficient to compensate for the additional length of rope required to permit operating to a depth of 3,000 ft. without increasing the rope pull. The only interruption in operation was the time required to install the longer ropes and to replace the skips and cages in the hoisting shafts.

It must be evident that the substitution of more expensive alloys for the ordinary materials used heretofore increases first costs somewhat, but in many instances their use offers the opportunity to cut down on power consumption by eliminating the handling of some dead weight, and reducing replacement costs. Consideration of available alloys may have quite a bearing on reducing the size of mining equipment required for a certain performance, and this reduction will be reflected in the capital cost of the equipment.

Discoveries and developments that come from a great portion of research and creative engineering on the part of equipment manufacturers represents the partnership role played by the manufacturer with the mine operator in producing improved methods or machinery to increase the efficiency of recovery and to reduce costs in the mining industry.

Electrical Industry Has Been Helpful Partner in These Developments

By JOSEPH S. PARRY, Jr.
Manager, Mining Section
Westinghouse Electric & Mfg. Co.

IN recent years mining men throughout the world have been faced with the necessity of maintaining their operations against increasing difficulties brought about by the exhaustion of the more easily mined coal or metal bearing ore bodies, and the necessity of replacing these with lower grade mines or continuing operations with increased difficulties such as long haulage or hoisting distances, thicker overburden in open pit mines and many more.

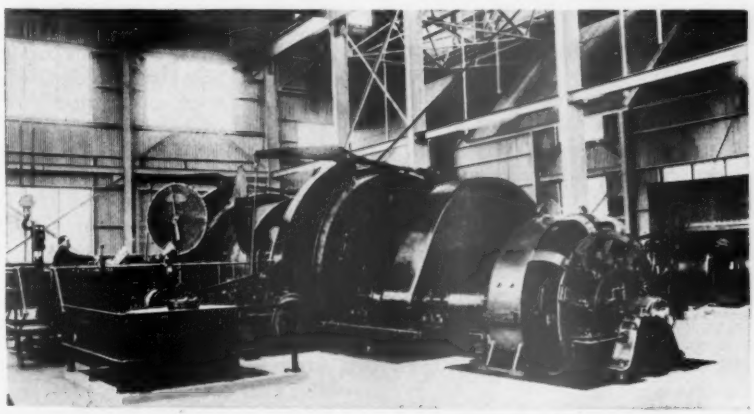
The mining machinery manufacturer, in cooperation with the mining engineer, has proved a friend in need and supplied equipment that enabled the operator to cope with his difficulties and to continue operations where otherwise he would have been unable to continue or to start afresh in more difficult territory. The electrical industry has been a partner in all this work, and by producing more efficient, compact and powerful motors as well as improved control, generating and rectifying equipment it has contributed generously in helping mine operators meet their mounting problems.

It is not within the scope of this article to go into the details of construction of the electrical equipment required for each application; it is possible only to give an overall idea of what is being done. A brief summary of some of the more important developments will be described.

Within the past few years, particularly in metal mines as the hoisting depths have become greater, the trend has been toward the increased use of variable voltage control either with flywheel motor generators to give almost constant power input from the line, or with synchronous motor generator sets where the power system has large generating capacity. In several recent installations and projects, two hoist motors have been applied or are under consideration. Other detailed refinements have been developed to give increased speed and accuracy.

With the more widespread use of machines and the concentration of power required at one point, the problem of getting power to the working places in coal mines has become increasingly important, and has made it desirable to bring the substation into the mine and thus convert to direct current where it is needed. Portable substations have been developed for this, the newest type using an ignitron as the rectifying unit. This type of substation, with its high efficiency at all loads and ability to withstand high overload, fits admirably into this picture. A substation of this type is described fully on page 26 of this issue.

One problem of the coal operator is the necessity of mining coal in very thin seams as thicker seams are depleted. Machines to do this have been and are being developed requiring motors and control of very compact design. This problem is complicated further where explosion tested or permissible equipments for gaseous mines are required.



1,500-HP. hoist motor, 400 RPM. Part of variable voltage drive

Rigid Specifications for Motors

The manufacturers of machinery for cutting and loading coal have been very active, and their requirements of motors call for units having characteristics as follows:

(a) Small diameter giving low inertia.
(b) Ability to stand high peaks without flashing.
(c) Ability to carry heavy overloads.
(d) Rugged construction to operate continuously in severe service.

In addition, for driving conveyors which are being used more extensively in mechanized coal mines, totally enclosed fan cooled motors both explosion-proof and non-explosion-proof have been developed to take care of this application fully and to reduce to a low point the maintenance problem in this type of work. Motors of this classification have been found very satisfactory in other mine applications such as driving pumps, fans, etc.

Totally enclosed fan-cooled DC motor for use in gaseous coal mines and other hazardous locations

Electricity in Open Pit Operations

The electrical industry has been able to develop and manufacture equipment to meet the special requirements of various types of mining service. In the field of open pit mining with the exhaustion of the coal with thin overburden, large, fast and more powerful shovels are required.

The modern shovel for open pit operation in either coal or metal mines, employing variable voltage control and rugged motors, is solving this problem. With variable voltage control a generator is used for each motor except where a double circuit generator with its two separate circuits drives two motors. The equipment consists essentially of the motor generator set with its AC driving motor and the required number of generators. The motors which drive the shovel and supply power to the various motions—namely, hoist, swing and crowd—are direct current mill type units designed so that the generator will stall at a value which will not damage the equipment; they are made to withstand severe service and high temperatures. The control is rugged and simple, consisting of incoming line breaker necessary heavy duty contactors, resistors and details. The individual items are coordinated into a complete and integrated design that gives the shovel great speed, power and flexibility.

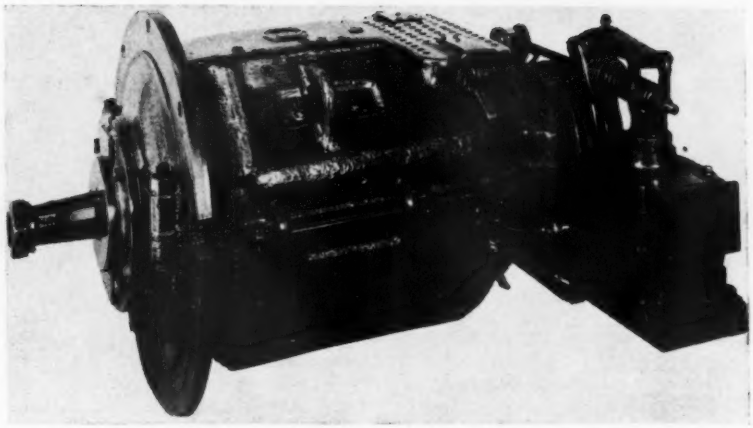
In an article of this kind we would be remiss not to mention mine locomotives which have adapted themselves over the past few years to the exacting requirements laid down by this service. There are available today locomotives of high rated horsepower suitable for operation in very low height mines and with their other dimensions held within exacting limits. To mention only two examples:

One design of locomotive for thin seam mines has a nominal weight of 20 tons with two 110 hp. motors and an overall height of 34 inches.

The other example is a 38-ton unit having a total of 360 hp. in three motors with a height of 46 inches. This machine was designed for long haul with heavy grades against the load.

For gaseous mines permissible battery locomotives and explosion tested cable reel locomotives have been developed giving the mine operator still another tool to combat his increasing difficulties.

The modern mine employs electrical equipment at every turn and the electrical industry is proud that it could contribute to the solution of some of the operators' problems.



Vertical shovel motor—one of two driving the swing motion of a 5-yard shovel

MODERN MINE Mechanization

By F. L. STONE
Industrial Department
General Electric Company

IT is encouraging to note that the mining operators are following the general trend of modern industry. They are discarding the old and inefficient, and I might say traditional methods, and are modernizing as rapidly as money and conditions will permit.

The problems to be solved in providing tools for this modernization have not been simple. Many unforeseen obstacles were encountered which caused many failures. This meant long delays and cost the manufacturers much money. Machines which were fairly satisfactory in some mines could not be used in others. The most suitable type of motors and control was not always available. Headroom was always a limiting feature, and in many cases handicapped the designer to a marked degree.

However, notwithstanding the handicaps, we have today motor-driven machines which are meeting the requirements of the majority of coal mines. I refer mostly to coal mine modernization, but the metal mines have not been idle. Their problems are again much different from that of the coal miners, but much progress has been made here.

Coal, for example, is today undercut, overcut, and slabbed by universal cutting machines. It is drilled electrically for shooting, and then loaded into cars or on conveyors by loading machines. All these machines are motor driven. Today hand shoveling of coal is fast disappearing. We see no more pictures of a miner lying on his back with a pick and no more lumination than one gets from a single candle. There are many coal mines where the complete mining process is handled by mechanical devices, and many other mines are to a large extent mechanized.

It is obvious, of course, that with the many and greatly different systems of mining, the same machines will not be adaptable to all mines. This complicates the situation somewhat. However, we have available today a machine for each of the major operations in the mines. In 1937, as a result of this mechanization, 94,000,000 tons of coal were mechanically loaded. As a matter of comparison, indicating the increased mechanization trend, 78,000,000 tons were loaded in 1936, and 56,500,000 tons in 1935. The wholehearted cooperation between the oper-

ators and the manufacturers is solely responsible for this condition in the coal mining industries.

It rather looks as though modernization is absolutely necessary today if operators who have not joined this procession wish to stay in business.

In open pit mining we find complete mechanization. In the earliest strip mines, if one can call them mines, horse scrapers were used to uncover the coal. There was, of course, no future in such a method. The first ray of hope came with early steam shovels. These were limited in size, and could handle only shallow covers. Then came the electric power shovel with dippers in the stripping machines starting at 8 cu. yd., and then increasing by steps, as the shovels proved their efficiency, to 12, to 18, to 22, and finally to the mammoth 32 cu. yd. machines. They may even be built larger in the future. With these latter machines it is possible to uncover coal 40 to 45 ft. below the surface. This coal after stripping is loaded in cars or trucks by 2½ to 4-yd. loading shovels, from where it is carried directly to the washers.

There are many special problems which crop up from time to time in all mining operations. An example of this is the ever present hazard of methane gas in coal mines. To meet this condition, electrical equipment has been built and pronounced by the Bureau of Mines as safe as it is humanly possible to make such equipment. It is unfortunate that this type of construction is not more generally used.

Full Automatic Pumps

Many mines are confronted with a very serious pumping problem. To meet this condition the manufacturers have designed, built, and installed fully automatic pumping stations. The sequence of operation is started from a float in the storage sump. The pump is primed and brought up to the full speed and full capacity entirely automatically. These installations are protected against all possible contingencies, such as failure to prime, etc.

The preparation of coal for the market has improved very greatly. Many new washeries and preparation plants have been built, and the customer now gets clean coal sized to such dimensions as he can most economically use. It is free from slate and other impurities. Here again the great majority of the process is automatic. The modern slate removing devices are most ingenious and extremely efficient. It is interesting to note that the average refuse from the washery, consisting of slate, clay, and other foreign materials, amounts to approximately 10 percent of the total product mined. From this it is evident that when a customer buys a ton of coal he gets a much cleaner product than heretofore.

The conditions of safety in and around the mines have improved very materially. Operators have encouraged safety suggestions and have been most energetic in eliminating possible causes of danger.

There are still many improvements to be made.

Proper illumination at the working face is receiving some attention from illuminating engineers, but the answer is still not available.

More Streamlined Ventilation Needed

Inefficient ventilation systems are still in operation in many mines with consequent loss in power and increased power bills. The proper selection of the type of fan and its drive, and scientific stream lining of the airways will be one of the best investments an operator can possibly make. The mine fan at best is a hog for power—so any appreciable reduction in the fan consumption shows quickly in the energy bill.

Many forms of power conversion can be improved. Any saving here will run into quite substantial figures.

The above and many other improvements are continually being worked on by manufacturers in conjunction with progressive operators.

Improved MODERN LOADING

Presented by | Gardner-Denver Co.
Bucyrus-Erie Co.
Marion Steam Shovel Co.

MECHANICAL MUCKERS Answer Demand for Speedier Loading

By B. P. SPANN
Gardner-Denver Co.

THE use of mechanical muckers or loaders in large railroad and water tunnels has been general for 15 or 20 years. It is only during the past few years that practical car loaders for mine development tunnels have become available to lighten labor and to speed up the drilling, shooting and mucking cycle.

In modern methods of tunnel construction, automatic feed drifting drills, carried on multiple drill mountings or "jumbos," are in very wide use. These drills, mounted as mentioned above, are being used increasingly in mining operations, particularly in driving exploration or development openings where speed is desirable.

To keep pace with the increased speed of the drilling operation, brought about by the use of the equipment just mentioned, various types of power loaders, which effect a similar increase in the speed of the loading or mucking operation, have also been developed.

To meet this demand, the Gardner-Denver Company developed and placed on the market two years ago the Model GD9 mine car loader. Since that time the original model has been supplemented by two modifications designated respectively the GD9H

and GD9L. The three models are of the same essential design and construction, differing only in the height of the car to which they are adapted for loading, and in the width of heading which may be cleaned up successfully.

These loaders are powered by two efficient, 5-cylinder radial air motors, each of which develops 9½ horsepower and has sufficient reserve power for effective operation at low pressures. Air consumption is about equal to the requirement of one drill.

One motor is geared to the wheels for "crowding" into the muck pile and for traction. The other motor operates the digging dipper. All three models may be equipped for operation on tracks of 18 in., 20 in., 24 in. or 30 in. gage.

Miners become expert in handling the loader after a short time. Native operators are handling them with complete success in South Africa, Peru, Bolivia and the Philippines. These loaders are also in use in Mexico, Australia and Europe.

Reports covering the operation of the loaders clearly indicate the sustained speed of the loading operation which is possible by their use.

A report from a gold mine in the Philippines, where a long 8 ft. x 8 ft. drainage tunnel is being driven, cites an average advance of 31 ft. per day of three shifts, involving the drilling, blasting and mucking of five rounds each day.

Another report covering the work of the loaders in one of the large western copper mines shows that the average time for loading a 14 cu. ft. mine car is from 50 to 60 seconds, while from 80 to 140 of these cars are loaded in a mine shift. In this same mine cars of 55 cu. ft. capacity are also successfully loaded by this type of equipment.

Capacity depends, of course, upon the condition of the material to be loaded and upon the adequacy of the car supply, but the above mentioned figures will give some idea as to the possible results to be obtained by the use of this equipment.

Materials going into the construction of the loaders are of the best, as dictated by the many years of broad experience by the company in building equipment for similar service.

Full dimensions of the cars in use, with details as to type of coupler and information as to the size of the headings, are essential in order that proper recommendations may be made.

Increased Speed and Flexibility Characterize Improvements in OPEN PIT MACHINERY

By F. C. RUHLOFF
Commercial Engineer
Bucyrus-Erie Co.

SPEED of operation and adaptability of equipment to individual mine conditions have been the lines of major progress in open pit loading during recent years. Increased operating speed, with consequent increased tonnages per excavator, has been achieved by marked decreases in excavator weight combined with increases in power and strength. With both excavator and haulage systems becoming more mobile, and with more diversified types and sizes of excavators available, it has been possible to set up a loading system designed to meet efficiently the demands of varying operations.

These factors of increased speed and flexibility not only make possible more efficient loading in most mines, but open up new areas which could not have been handled profitably by railroad shovels and the old straight line method of loading.

Increase in dipper capacities per unit weight of machine is one of the important factors permitting the increased output of modern excavators. The development of alloy steels and welding methods applicable to the new light-weight metals have made this possible. The following weight comparison of a complete 4-cu. yd. cast dipper with its load in copper ore, and a new type 5-cu. yd. welded dipper, which can be carried by the same shovel, shows how an increase of 25 percent in pay load has been achieved with only a nominal increase in total weight.

	4 cu. yd. cast dipper *pounds*	5 cu. yd. welded dipper *pounds*
Weight of dipper..	15,150	12,400
Weight of material	12,300	15,400
Total weight....	27,450	27,800

Use of welded, alloy steel dipper handles and booms has resulted in further decreases in front end weight with simultaneous increases in strength. This permits an increase in swing cycle speed which further adds to the larger output given by greater payloads earned by the light-weight dippers at every pass.

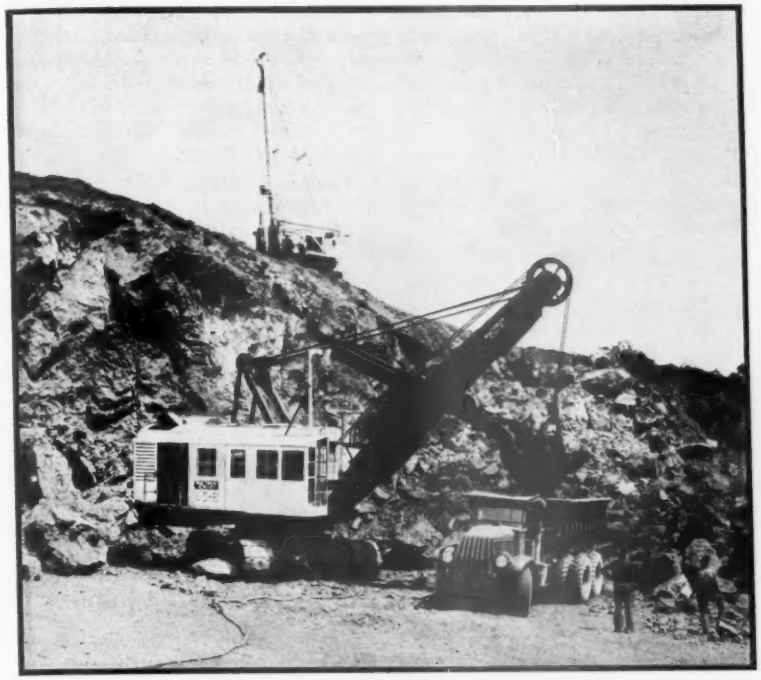
Electric Control Improvements

Further increases in digging speed and power have been made possible by developments in the electric control. Generator voltage in the Ward-Leonard variable voltage system has been increased, with a consequent relative increase of hoist, crowd and swing speeds. An increase in the r.p.m. of the generator set has offset the larger cost which the higher voltage would normally entail. Push button and magnetic control have increased the ease of operation and consequently the speed.

The simplification of field maintenance and repairs, through modern welding technique and careful refinements of design, has played a considerable part in reducing costs and keeping modern excavators operating a maximum percentage of the time.

Excavators Now Convertible From Shovel to Dragline

The convertability of modern mining excavators from shovel to dragline is playing an increasingly important part in efficient operation of certain types of mines. Where it is necessary to dig and load material below the plane on which the machine operates, on pitching seams, and where it is of advantage to spoil material without haulage, use of a dragline may



Modern mining shovel with welded, light-weight front end, working in an iron mine. Above is 9-inch drill, a size of increasing popularity amongst mine owners

prove advantageous. It has been found that a dragline bucket can be filled in properly prepared material as fast as a shovel dipper can. The elevating feature of the dragline is profitable where the ore is being loaded from deep pits which would necessitate sharp grades for hauling equipment.

Open pit metal mines have not yet taken full advantage of the convertability of modern machines. For example, the ability to use a dragline for stripping operations and then convert it to a shovel (after a definite loading and transportation scheme has been developed) can be of great service, especially in opening up new operations.

Coordination of the loading machine with the transportation units is, of course, of major importance. The mobility of the modern shovel, together with the flexibility of modern hauling equipment, has made possible opening of many new mining areas. Big pneumatic-tired trucks, tractor-drawn, self-dumping wagons of a great variety of sizes and special uses, adaption of belt conveyor systems, as well as modern improvements in standard rail haulage systems, offer the mine operator a wide selection of transportation system. The ability to choose a system of maximum effectiveness for a given operation is an important factor in increasing production and decreasing costs.

Tractors Now a Big Aid

In addition to pulling loads, the tractor, with scraper or blade attachments, is just coming into importance as a work unit in mining operations. Maintaining hauling roads, shifting track and making the final clean up cut are some of the profitable "odd jobs" now being handled by this type of equipment. This work all has a direct effect on loading, as it permits speeding up movement of hauling equipment and consequently helps keep the loading shovel busy all the time.

Recent developments in blast hole drilling also play their part in increasing tonnages loaded out in modern mines. Introduction of 9-in. and larger holes permits wider spacing of holes, and hence less linear feet of drilling for a given tonnage. Approximately the same number of pounds of explosive per ton of material are used, but the large holes permit better placement of explosive, eliminate necessity for springing, and give better fragmentation.

Larger Dippers Recently Installed on Mesabi

A modern size development in iron mining has been the introduction of the shovel carrying a 5-cu.-yd. cast or 6-cu.-yd. welded dipper. These machines, in use on the Mesabi Range and in Sweden, have proved nearly as mobile as the more generally used 4-yd. size. They have increased output because of their increased swing speed and greater dipper capacity, and seem destined for wide acceptance where tonnage requirements are high.

In recent open pit copper mine modernization, the 4-cu.-yd. cast and 5-cu.-yd. welded dipper size machine has been selected. This is due to present mine benches and the preference for several machines to permit either ore or waste being loaded at various points. Ramps dug between levels

Combination scraper and bullgrader unit used for stripping and maintaining dump and haulage roads

enable these machines to take advantage of their mobility.

Tower Excavator in Iron Mining

Another recent loading development in iron mining has been the tower excavator. A central head tower mounted over a glory hole about which the tower supporting frame revolves, and a caterpillar mounted tail tower are employed. The operation is similar to the usual slack-line tower excavator, with the scraper bucket carried between towers on a track cable having a maximum length of 700 feet. The bucket dumps on a grizzly at the head tower and the ore is carried out of the pit by a belt conveyor system.

Developments in LOADING UNITS AT STRIP MINES Just as Important as Publicized Advances in Stripping Shovels

By L. C. MOSLEY
Sales Engineer
The Marion Steam Shovel Co.

A GREAT deal of attention has been directed to the large coal stripping shovel, but little has been said about the loading shovel, which after all does the "mopping-up" and actually handles the pay material from the strip mine. While the romance of open pit coal mining has been confined to the mammoth stripping shovel, advanced developments equally as important have been made in the loading units. There is probably no better method to illustrate the advances than to show the growth that has taken place since the application of some of the older loading shovels, and to compare their size with some of the larger ones more recently applied to this service. It is interesting to find that the dipper capacity of some of the loading shovels of today is practically equal to that of the stripping shovel of a few years ago.

Slightly more than 10 years ago 8 cu. yds. was the standard dipper size for the largest coal stripping shovel; the standard loading shovel to follow this stripper had a dipper capacity of 2 cu. yds. Such an operation is depicted in Fig. 1, which shows an installation made about 1924 by the Solar Coal Company near Belleville, Ill. The stripping shovel in the background has a dipper capacity of 8 cu. yds. and the loading shovel in the foreground is equipped with a 2-cu. yd. dipper. The loading unit has a working weight of 72 tons, is fitted with rheostatic control and is equipped with a dipper made of ordinary plate steel. This installation, at the time it was made, was the last word in coal stripping and loading equipment.

During the intervening period since 1924, the tendency in stripping shovels has been toward larger machines with constantly increasing dipper sizes. The 8-cu. yd. dipper gave way to one of 12 cu. yds., and it in turn by fast successive steps to the 16, 20, 26, 30 and today there are several 32-cu. yd. dippers in use.

Greater Loading Rate Required by Larger Stripping Units

This rapid growth in dipper size on the stripping shovel has resulted in a great increase in yardage of overburden handled and a consequent increase in the daily, weekly or monthly amount of coal uncovered. This situation in overburden handled has in turn made it necessary to increase greatly the output of the loading shovel in order to keep pace with the stripping unit. On most properties tipple operation is limited to a single shift per day, and as a result it is not possible to use the loading shovel on a multiple shift basis. Therefore, in order to handle the coal, it has been necessary to provide for a greatly increased loading rate.

This increase in loading rate has been obtained in three ways—first, by the adoption of larger size strictly modern shovels for loading; second, by increasing the speed of the shovel motions by the installation of oversize electrical equipments; and third, by the use of high strength, light weight alloy dippers.

Coal is relatively light in weight when compared to earth, stone and other materials that a shovel has to handle. Therefore, larger dippers with the standard working range, or increased working ranges with the standard dipper will result when a shovel is equipped for coal loading. Since ordinarily neither long range nor extremely high dump is a factor to be considered, the larger dipper is installed to provide greater capacity. But even this normal increase in dipper size will not permit the use of dippers large enough to obtain the greatly increased outputs resulting from the large stripping shovels, and therefore larger loading shovels have to be used.

These loading shovels are strictly modern in every respect, having incorporated in them the latest improvements in design, and having used in their construction the particular type and kind of alloy steel best adapted to meet the duty required. They are crawler mounted, electrically operated, equipped with Ward-Leonard control, amply powered and so arranged that all movements of the shovel, including propelling and steering, are under the control of the operator. Thus every facility is provided for operating the machine at a rate to produce the high tonnages required with the maximum of speed and efficiency.

Ward-Leonard Control System Generally Used

On practically all loading shovels for the larger stripping operations, the Ward-Leonard system of control is used and the electrical equipments are designed to give fast accelerations and high ultimate speeds to the various motions. In many instances this is accomplished by installing electrical devices larger than those used on the shovel when applied to other service. The control has been simplified and so arranged as to permit of fast operation, without shocks and undue stress to the mechanical parts. Thus the design and construction of the shovel proper and the scientific application of the latest and most modern electrical equipment results in a digging unit not only of very desirable operating characteristics, but of high operating speeds as well.

Fig. 1. Early stripping installation (1924) at Solar Coal Co. Stripping shovel dipper capacity 8 yds. and loading shovel 2 yds.

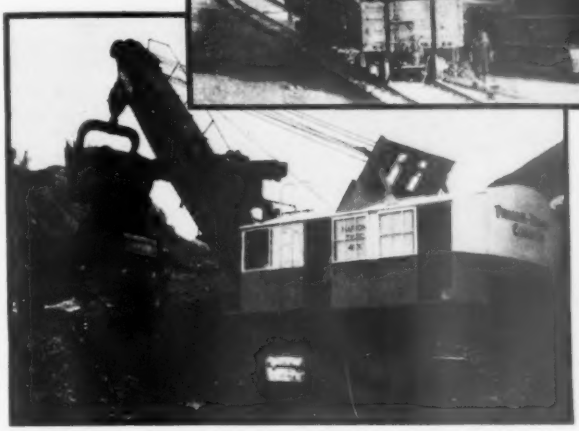


Fig. 2. Modern 5-cu.-yd. loading shovel at Truax-Traer Coal Co.

A 5-cu. yd. coal loading shovel may be seen in Fig. 2, which shows a Marion Type 4101 electric shovel owned by the Truax-Traer Coal Company at DeSoto, Illinois. The machine has a working weight of approximately 117 tons and is equipped with Ward-Leonard control. Production reports indicate averages of slightly more than 4,500 tons in a 7-hour shift although at times it has exceeded 5,000 tons for the same period.

The capacity of the loading shovel depends, among other things, upon the total load to be lifted, which includes the dead weight of the dipper plus its live or pay load. If the weight of the dipper can be reduced, a correspondingly large pay load may be handled without exceeding the rating of the hoisting machinery or the stability of the shovel.

One of the outstanding recent developments for this service is the light weight, high strength welded alloy steel dipper. The advancements made in the production of high strength alloy steels has given the shovel manufacturers a new material with which to work, and advantage is now being taken of it in dipper construction. Thus it is possible to increase still further shovel output by the use of the light yet strong dippers of increased size when compared to the older dippers of conventional design.

Typifying the largest strip loading equipment, an electric coal loading shovel was recently installed on the property of the Northern Illinois Coal Corporation near Wilmington, Illinois, which has a working weight of approximately 170 tons and is fitted with a 7½-cu. yd. dipper. Here we have a loading shovel with a dipper having practically the same capacity as that of the stripping shovel of 1924.

Ultimate in Size Probably Not Yet Reached

As each new development is made on a piece of machinery, either in size or construction, the question naturally arises as to whether the ultimate has been reached. Such has not been the case in the past and there is no indication that it has at the present. While predicting the future is usually dangerous, it is felt that future specifications for coal loading shovels will be met as soon as the demand for such machines arises.

Urge Coal Bureau Site In West Virginia

Copies of a resolution were recently forwarded to members of West Virginia's congressional delegation by the West Virginia Mining Institute asking that West Virginia University be selected as a site for a proposed coal research bureau provided for in the law which created the National Bituminous Coal Commission.

The complete resolution, signed by Carel Robinson, of Ward, president of the Institute, and Charles E. Lawall, its secretary, is as follows:

"WHEREAS the National Bituminous Coal Commission is authorized to initiate, promote, and conduct research designed to improve standards and methods used in the mining, preparation, conservation, distribution, and utilization of coal and the discovery of additional uses for coal; and

"WHEREAS we, the men of the coal industry, believe that it is essential to provide a program of this kind to maintain the position of the bituminous coal mining industry among its competitive fuel industries; and

"WHEREAS West Virginia has the greatest production of bituminous coal in any State in the Union—nearly a million people in the State depend directly and indirectly on the continued production of this basic fuel; and

"WHEREAS the West Virginia University has already contributed much scientific research work dealing with practical problems of the coal industry and can provide and maintain adequate facilities for an enlarged program of research: Therefore be it

"*Resolved*, That we, the executive board of the West Virginia Coal Mining Institute, commend to the United States Bituminous Coal Commission and to our representatives in Congress their favorable consideration of the university in making plans for the establishment of a research bureau on bituminous coal."

FAST and EFFICIENT HAULAGE

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Size of TROLLEY LOCOMOTIVES and Horsepower Per Ton Weight Doubled Since Introduction

By G. H. SHAPTER
Transportation Department
General Electric Co.

THE electric trolley haulage locomotive has long been one of the most important pieces of machinery used in underground coal mines. Without its use today the modern mine would be helpless so far as moving large tonnage. From the early beginning, back in 1890, when locomotives were first introduced extensively, the capacities were represented by a motor equipment of 7 to 8 horsepower per ton of locomotive weight, and haulage locomotives were built in sizes up to 15 tons. The operating speed of these earlier locomotives was in the neighborhood of 6 or 7 miles per hour when pulling their full rated drawbar loads.

Compared with these early beginnings, the present day modern electric haulage locomotive is built in sizes up to 30 tons in a single unit, 60 tons, if necessary, in double or tandem units. The motor equipment on these present day locomotives is equivalent to about 15 horsepower per ton of locomotive weight, and the speeds at normal drawbar load are 9 to 10 miles per hour.

It is seen by the above that the motor horsepower requirement has steadily increased until it is about twice as great as in the beginning. The operating speeds of the locomotives have been increased approximately 50 percent, and obviously with twice as much motor capacity and greater speed, the present day haulage locomotive can and does handle more than twice as much output in a day or in any given unit of operating time.

About 15 years ago the writer presented a paper on the general subject of mining locomotives at Pittsburgh under the auspices of the Iron & Steel Electrical Engineers Institute, and at that time reasons were pointed out why haulage locomotives had reached their limits of haulage capacity, except that they be equipped with forced ventilation through the traction motor frames. The main reason this became evident was because if closed motors of greater and greater horsepower capacity were demanded, heavier and heavier traction motors would necessarily be the result, and so it would be brought about that instead of a locomotive weighing say 20 tons with 15 horsepower per ton of motor capacity, it might weigh 25 tons if 20 horse power per ton were attempted. The generally accepted standard of motor capacity had been and still is based upon the one hour totally enclosed rating of motors, whereas the continuous capacity of a motor is really more important because continuous haulage service at heavy drawbar loads demands motor output in such large volume that an ordinary motor cannot dissipate the heat losses incident to the service unless it be ventilated.

Huge Service Performed by Mine Locomotives

It is seldom realized as to just how powerful a modern mine haulage locomotive really is. Probably it is safe to say that with a single exception of railway, main line freight and passenger locomotives, the mining locomotive does more work and hauls more material per hour or per any unit of comparison than any other type of locomotive in existence, whether it be a steam switcher, an electric switcher, an electric Diesel switcher, or whether it is used in railroad, industrial or other mining service.

A mining haulage locomotive, when provided with good track, dry sand and proper control equipment, can be operated on loads corresponding to 25 or 30 percent adhesion for distances up to perhaps 10 miles, when hauling a loaded trip out of a mine; or, if the empty trip determines the maximum load, for the empty trip into the mine and return in a reverse direction with but a short time delay at each end for changing the trains. Thus we find the mine haulage locomotive in continuous motion probably a matter of 80 to 90 percent of the actual time. Under such a condition the load factor of electrical apparatus installed in the locomotive will be as high as 65 to 70 percent. In no other operating condition except those above mentioned do we find an operating service as heavy as this.

The foregoing statement is on the assumption that the motors are operated as motors in contrast to generator action which is incident to the various forms of dynamic braking. This may easily add to any locomotive's operating power an additional

25 to 50 percent of power generated, which is lost or dissipated in the resistances or other means used to obtain dynamic braking. Heating of the motor windings and core goes on under dynamic braking load as well as motoring load. Hence the greater and greater need for proper ventilation of the traction motors.

Modern Installation Typified by Vesta Mines Equipment

To more clearly present this feature to the reader, it is thought helpful to describe a recent and successful installation of locomotives which have everything that modern engineering can apply in the way of apparatus, and which locomotives are working in one of the mines of a large coal company which is known as a "captive mine," and therefore producing coal as a rule more continuously than other purely commercial mines.

Fig. 1. 2 G-E mine locomotives, multiple-unit type, 20-ton, 48-in. gage, coupled together

At California, Pa., and Vestaburg, Pa., The Vesta Coal Company, a subsidiary of the Jones & Laughlin Steel Corporation, operates two large mines which are known as No. 4 and No. 5. The combined output of these two mines was 3,120,000 tons in 1936, produced at an average rate of 7,500 and 6,000 tons per day per mine, respectively. In order to take care of further expected increased haulage requirements as to distance, as well as increased tonnage, this company improved and enlarged their hauling facilities. This was done by (1) installing an improved road bed, and (2) by adding more powerful locomotive units capable of hauling as much as 500 tons of coal per trip over a difficult profile of almost five miles.

90-Pound Rail Used

Realizing that the ultimate economy of locomotive operation depends greatly upon the track construction, The Vesta Coal Company installed 90 pound rail on rock ballasted roadway. This type of construction is undoubtedly equal to and far better than the average railroad track.

The new haulage locomotive which The Vesta Coal Company purchased consisted of two 40-ton, 500 volt locomotives, each consisting of two 20-ton tandem units (see Fig. 1).

As will be seen, these units are connected together in what is known as primary tandem by a rigid draw bar between them. By primary tandem is meant that each pair may be operated from either of the two units, depending on which one the operator wishes to ride. The units may be either separated or operated as individual 20-ton locomotives, should occasion require. These units are arranged with coupler plugs and sockets, so that the following tandem arrangements are available if desired: (a) operating ends to the center; (b) operating ends outward; (c) one operating end and one front end to the center.

Ten-Point Accelerating Control

Both units have air brakes and are operated by a contactor control scheme of the multiple point type, all motors being at all times connected in parallel—that is, there are no series starting points on this control. The control provides 10 accelerating points for motoring and 10 points for rheostatic braking. If a control having an infinite number of accelerating points were practical, this would be the ideal accelerating control, because the increments of acceleration from step to step would be so small as to be unnoticeable and the locomotive wheels would not slip unless the very maximum adhesion were required.

A 10-point parallel accelerating control is a practical compromise, and has proven to be in this particular instance a far better accelerating control than the previous types which were of the so-called series-parallel kind. Prior to the installation of these 40-ton locomotives, The Vesta Coal Company had installed other 20-ton units that were provided with a progressive series-parallel control. It was found that while the series-parallel control was able to start and handle a trip for which it was designed, a greater load was demanded and difficulty was experienced in getting started. The Vesta Coal Company cooperated with the manufacturer in developing a straight parallel multiple point control which was installed on the same locomotive. By this means the unit was able to start 125 cars under the same identical grade conditions where before it could start but 80 cars. Hence The Vesta Coal Company at least was convinced that there was no better type of control than the straight parallel type which they have subsequently purchased.

The accompanying tabulation covers a cycle of operation of one 40-ton locomotive from what is known as No. 10 face to No. 2 hill siding, as designated by station marks—318+00 to 100+00. The grades encountered during the outgoing and incoming trips are indicated, together with the

Cycle of operation of a 40-ton, 500-volt locomotive at Vesta No. 4 Mine

Outbound Train - 925 Tons including locomotive

Station	% Grade	Dist. in Ft.	Tractive Effort	H.P.H. Average	Min.	Amps. Aver.	Volts at Aver.
Start 318400 to 290400	41.3	2800	37500	6.0	5.3	1490	500
290400 to 250400	4.43	4000	22000	9.8	4.8	940	500
250400 to 195400	-1.3	5600	(-)10200	15.0	4.2	580	500
195400 to 160400	0	3500	13800	10.7	3.7	672	500
160400 to 115400	41.0	4500	32400	8.8	6.0	1280	500
115400 to 100400	-.67	1500	0	0.6	3.0	0	
		21900 Ft.			26.0 Min.		

Inbound Train - 625 Tons

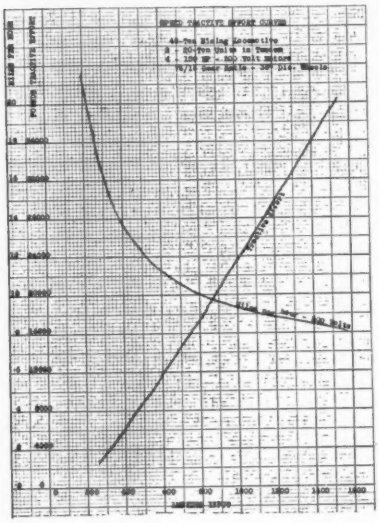
100400 to 115400	4.67	1500	30000	0 to 11.0	1.8	1200	500
115400 to 160400	(-)1.0	4500	-3120	20.0	2.5	240 (gen)	600
160400 to 195400	0.0	3500	6400	13.7	3.0	400	500
195400 to 250400	41.3	5500	17500	10.0	6.3	800	500
250400 to 290400	-.43	4000	2760	18.0	2.5	240	500
290400 to 318400	-1.3	2400	(-)4700	16.0	3.7	340 (gen)	600
318400		400	23000 Brakes	16.0	.8	0	0
		21900 Ft.			16.3 Min.		

Total Round Trip - 43800 Ft.
delays at each end of trip.

44.8 time in motion
5.0
49.3 Schedule time.

tractive effort load which is required on each section of the track, whether it be a motor load or a generated load, the latter indicating a dynamic braking condition.

The accompanying characteristic curve shows four motors, 150 horsepower, 500 volts, each operating on a trolley delivered voltage of 500, and



Characteristic speed and tractive effort curves for 40-ton mine locomotive

the curves clearly indicate tractive effort, miles per hour and ampere input to the 40-ton locomotive.

It will be seen that an outgoing loaded trip covers a distance of 4⅛ miles in 26 minutes at an average speed of 838 ft. per minute, equivalent to 9½ miles per hour. There is a dynamic braking condition of over one mile on a down grade of 1.3 percent where the locomotive holds back the train at a speed of 15 miles per hour, and the power generated by the motors is absorbed in the locomotive resistors. The empty train with 125 cars is taken back to No. 10 face in 18.3 minutes at an average speed of 1,195 ft. per minute, or 13.6 miles per hour. Two and a half minutes are allowed at each end for changing the trip from empty train to loaded train and vice versa, and a complete scheduled round trip is maintained every 49.3 minutes.

The load handled on the outgoing trip is 875 tons behind the locomotive, but on the inbound trip 375 tons. The net amount of coal hauled per trip is 500 tons.

4,500 Tons Per Locomotive Per Shift

Each of the 40-ton locomotives may handle nine round trips per eight-hour shift, producing 4,500 tons of coal per locomotive. There are two 40-ton tandem locomotives for this operation, and a third unit of older date is available for this haulage, making a combined main haulage that will produce 13,500 tons in one shift over a distance of 4⅛ miles and under grade conditions which are none too easy. A realization of the amount of coal so hauled might be had by considering a railroad coal train of 50 gondola cars, a train of approximately one-half mile long, and holding on the average of 2,750 tons. It would take five such railroad trains to handle the output from this haulage-way, as described above, all of which is handled by three 40-ton locomotives.

The kilowatt hours input per round trip of the above described train is 310, reckoned at a 600 volt trolley. All the speeds as given in the tabulation are on the basis of 500 volts delivered to the locomotive, and probably the actual average voltage is more in the neighborhood of 550, thus an increase in speed over and above the cycle would be realized.

Three hundred and ten kilowatt hours input means that the haulage efficiency is 0.62 kilowatt hours per ton hauled over the distance of 4.125 miles, or 0.145 kilowatt hours per ton of coal hauled one mile.

Use of Motor Driven Blowers Increases Armature Life

Many improvements in design have been effected during recent years, and it is by reason of these that heavy schedules such as the above may be handled. Probably the most important improvement in the design of haulage locomotives is the application of motor driven blowers, as otherwise motors possibly four times as large physically would be necessary.

The application of motor driven blowers has materially reduced the frequency of re-winding traction motors, and it should not be unreasonable to expect a life of at least five years of every armature winding in service.

Improved Axle Linings Aid Proper Lubrication

Another very important improvement is in the preparation of both the plain bronze type axle linings and the anti-friction type, both of which reduce expenses of maintenance by virtue of the fact that dirt, sand, etc., are excluded from the bearings, and lubrication is more properly accomplished because of the fact that the lubricant is retained for a longer period of time within the bearings. This axle improvement, whether it be carried out with plain bearings or anti-friction bearings, eliminates to a large extent broken gears and pinions, and maintenance for these reasons is probably as little as one-tenth of former amounts experienced in similar services.

Alloy steel continuous ribbon resistors make frequent repairs of this item unnecessary, and it should no longer be considered essential to remove a locomotive from service on account of broken cast grids.

Contactor controls applied to these heavy duty locomotives provide for adequate interruption of the electrical circuits and eliminate the expensive frequent repairs incidental to the use of drum controllers. When drum controllers are used, their operation is greatly improved by the use of line breakers.

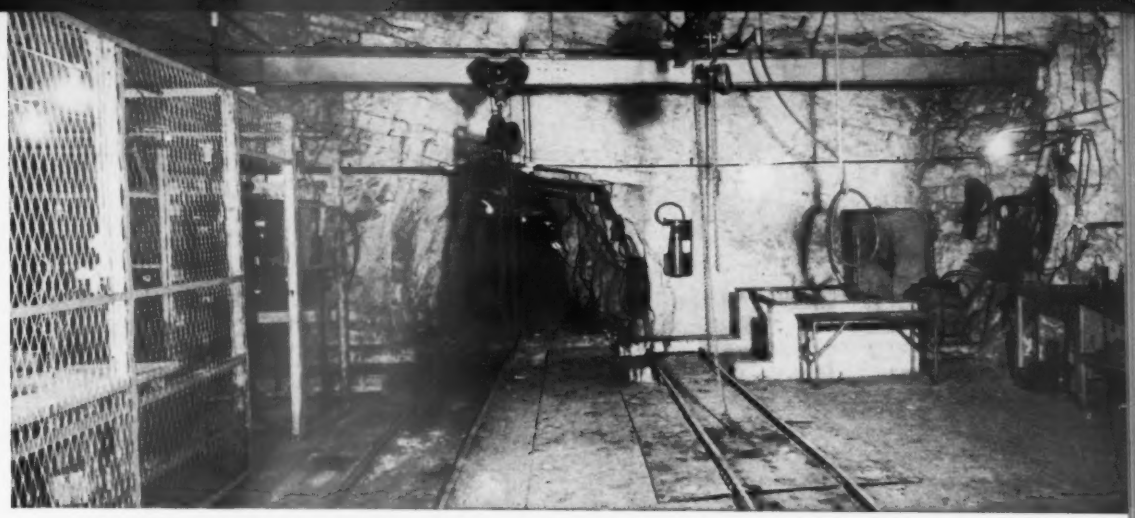
The mechanical construction of haulage locomotives has also improved greatly because of the steady advance in the art of welding. End frames made of fabricated welded construction are stronger than cast steel, hence will take more punishment.

Spring equalization of the chassis suspension has received considerable attention, and many changes from time to time have been effected, so that a well designed mine haulage locomotive should ride just as easy and comfortable as a railroad passenger car, providing of course that it has a reasonable track and road bed under it.

Old Workings Unwatered By Queen Seal

Queen Seal Mining Company, in southwestern Stevens County, Wash., when it unwatered its workings this spring, found tools and equipment in perfect condition where they had been left when work ceased more than 30 years ago. It was only necessary to wipe off the muck. The mine has been unwatered to the 200-ft. level and a shaft will be sunk 50 ft. deeper.

"We took out 900 ore carloads of muck from the 1,500 ft. of tunnels," A. W. Tyler stated.



In the charging station a heavy-duty tramrail and hoist extends over the track and to well-ventilated steel-and-concrete charging racks on each side (one may be seen at right—one on left is concealed by wire-screen partition)

RELAY BATTERIES Meet the Needs of Heavy Haulage Demands for Storage Battery Locomotives

By GEORGE E. STRINGFELLOW
Vice President and Division Manager
Edison Storage Battery Division
Thomas A. Edison, Inc.

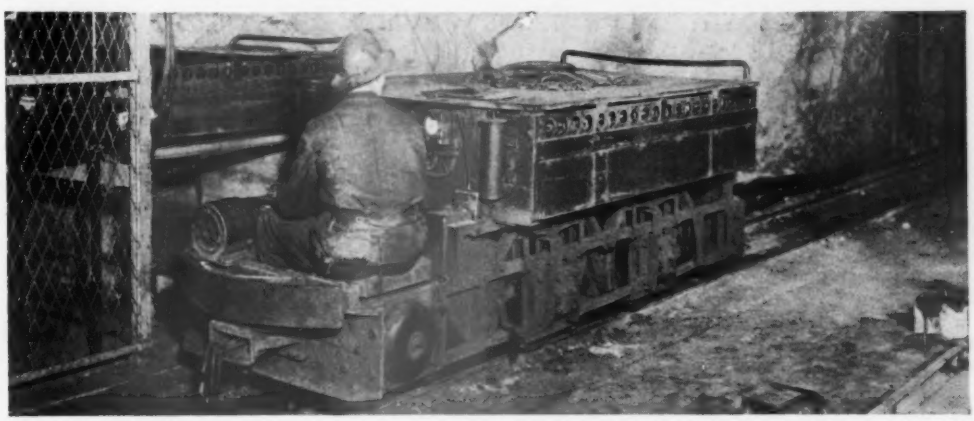
CONTINUOUS transportation is certainly one of the essentials of low-cost mining. Each step in the movement of mined material from face to tipple or from chute to skip is dependent upon the preceding one. Failure of any link in the chain slows up or stops production with a decrease in tonnage per day and an increase in cost per ton.

Utter dependability of the transportation system, as well as efficiency, is, therefore, a *must*. The use of electricity in the modern underground railways of the mining industry is the result of a gradual evolution in the course of which nearly every available form of power has been tried. Electricity has proven immeasurably superior and has very largely supplanted other forms of power.

The final stage in the evolution has brought about a broad application of storage battery power for a large and important part of the task of handling mined material.

In the metal mining field, the use of storage battery power for main haulage has been extensive for many years, although explosion hazard is a much smaller factor than in coal mining. The answer to this lies in the fact that the battery motor has demonstrated savings in operating costs. While it is true that the main haul of the metal mine is often shorter and more level, this does not, of itself, mean that storage battery power cannot also save money in the main haul of a coal mine.

The fact that the daily duty of a main-haulage locomotive may require more energy than it is practical to supply with a single battery raises a problem easily solved by relay batteries. As a matter of fact, the main haulage locomotives have been operated in this manner for a number of



Following arrival of locomotive, the discharged battery will be taken to empty charging rack, to be replaced by freshly-charged one seen at left

years in a limited number of coal mines.

Isolated Coal Mine Solves Haulage Problem

Located at the head of Berwin Canyon, Colo., 20 miles from the nearest city, the Bear Canon Coal Company has found the characteristic dependability of storage battery haulage an important asset in maintaining consistent daily delivery of coal to its modern tipple at Vallorso on a branch line of the Colorado & Southern Railway which winds down the canyon to Trinidad.

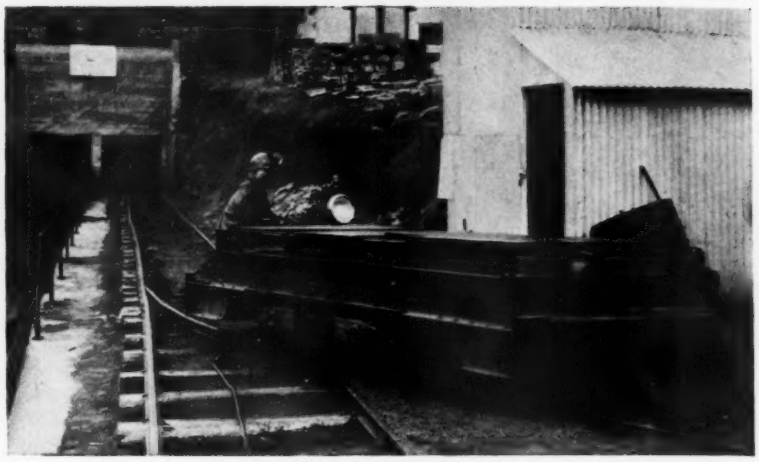
Successful operation of the property depends not alone on steady output of coal but also on providing the limited number of miners at a camp with regular employment during the limited hours of the day in which they are permitted to work. Therefore, dependable operation, along with freedom from the usual fire hazards, was one of the principal reasons for the adoption of storage battery haulage. The first battery motor was installed in 1917, since which time the management has had ample confirmation of the soundness of its selection.

The entrance to the mine is through the side of the canyon and the distance from there to the present working places ranges between 1,100 and 1,600 feet. There are no trolley wires anywhere in the mine, the entire haulage from the face, through the crosscuts and along the main line being handled by storage battery locomotives. Grades run up to around 3 percent.

An average of six to eight trips are made to the tipple per 7-hour day, each consisting of 10 to 15 cars with loads of approximately 2½ tons per car. Modern roller-bearing cars are in use.

Recently a cloud burst flooded the main haulageway, entirely covering the locomotives for several days but causing no permanent injury to either the locomotives or the storage batteries.

Other modern mining practices include extensive rock dusting and thorough ventilation although it is in the haulage and the transportation to market in which probably the most spectacular advance has occurred since the property was originally developed in 1873. Then there was no power haulage in the mine and no railroad to the market; the coal was hauled by ox-cart to Pueblo, Colo., a distance of 75 miles.



Mine locomotive equipped with 84 A8s. Operator wears an M.S.A. Skullgard and Edison Electric Cap Lamp

Power Costs Can Be Cut

A thoroughgoing analysis of all cost factors as applied to the individual mine is the best approach to the question of determining the most advantageous solution of the transportation problem.

In the metal mine, the usually limited capacity of skip pockets underground makes it necessary for all practical purposes that hoisting and tramming be simultaneous.

With use of battery power, the tramming load becomes a charging load which can be connected at times when no hoisting is being done. Thus a substantial reduction in maximum demand is achieved with corresponding savings in power costs. In this way, some mines have cut the cost of tramming power to zero. Furthermore, a battery-charging load is always much steadier than the tramming load itself so that even under continuous tramming, with relay batteries constantly on charge, the maximum demand is lower than with direct power transmission through trolley wires. In any case, it is desirable to restrict battery charging to off-peak hours so far as possible. Useful in that respect is the rapid-charge ability of alkaline batteries.

Use and Attentive Maintenance of Proper TRACK and ACCESSORIES Pays Dividends

By R. L. GILLESPIE
Manager of Sales—Frogs, Switches and Trackwork
Bethlehem Steel Co.

PROPER design of mine haulage equipment calls for a layout based on mining forecasts which indicate the loads to be handled, the points at which these loads are to be received, the class and intensity of the traffic, the duration of the need for specified transportation and the characteristics of the haulage. A factor of safety must then be imposed on these determinations.

When not scientifically constructed and properly maintained a mine track may at times be as expensive in upkeep as a railroad track, incredible as this statement may appear. Mine tracks are too often laid with unsuitable materials, improperly and inadequately maintained, making their life entirely too short. Labor is continually spent on patching and repair.

High priced track materials alone will be an expense rather than an economy unless properly installed and

maintained. Track should be well drained, lined, surfaced, and ballasted, laid with 40 or 60 lb. rail, angle joints, ¾-in. track bolts, 9/16-in. x 5-in. track spikes of uniform design, 6 x 8 in. or 5 x 7 in. ties of decay resisting wood. In main haulage where heavy equipment is employed, a properly designed type of tie plate should be used. This increases the life of wooden ties. Steel ties or gage rods of proper design should be sandwiched in between every three to five wooden ties on straight track; on curves, one steel tie should be used for every two to three wooden ties, depending upon the radius of the curve. This results in material savings in maintenance cost.

Advantages of Steel Ties in Room Tracks and Turnouts

In room tracks and turnouts, steel ties offer enough advantages over wooden ties to offset their higher first price. They are quickly laid, can be used over and over again, and they make the track safe because they hold the rails to gage more securely, thus eliminating spreading which may cause derailment. They save head room and can be taken in and out of the track quickly without disturbing the rail, and with no other tools than a hammer for riveted clip ties or a wrench for bolted clip ties. There are no spikes to drive, no gaging to be done, and they are easily and conveniently handled. Designs to fit all track conditions are available. These ties are also ideal in locations where wooden ties become dry rotted.

An interesting development is the so-called Ar-Moored tie, a wooden tie with bolted-on steel tie, which, based on extensive service tests, promises to give very satisfactory service.

The ease with which steel ties can be installed and taken out of track speeds up the loading of the cars and increases the efficiency of cutting and loading machines. This is particularly true where it is necessary to advance the track to allow the cutting machine to work as close to the face as possible. Before the loading machine can start operation this part of the track will then have to be taken up again. Such changes are made as frequently as three times in 24 hours. Wood ties used under such conditions soon become "spike killed."

Steel Ties in Good Condition After 30 Changes

Turnouts should be of proper design. Heavy-duty designs are strongly recommended where large and heavy equipment is used. Turnouts equipped with steel ties cut to length, rails curved and drilled, ready to lay, increase the efficiency of track-mounted equipment; when such equipment is used it is frequently necessary to change the room turnouts as often as once every two weeks. With steel ties these changes can be made in less than half the time required for turnouts laid on wooden ties. And while the latter become "spike killed" after three or four applications, steel ties are still in good condition after more than 30 changes.

Due to the accuracy with which these turnouts are constructed, the heavy machinery can be moved with greater ease and at a higher speed. Derailments are less frequent, and wear and tear due to pounding and impact is reduced.

A portable turnout recently introduced for underground haulage has proven highly advantageous in driving entries and necking rooms, and for cross cuts from one room to another where track-mounted equipment is employed. This turnout permits more efficient handling of cars to the loading machines, whether these machines are track mounted or operated on caterpillars.

The new turnout is quickly installed and is readily moved from one location to another, whether used on entry track or on room track for cross cuts. The resulting saving in time is reflected in a material increase in the number of cars loaded. Extra coal cuts are also added on the narrow work and room necking, and the necessity of laying temporary room turnouts while driving entries is eliminated. This increases the number of feet advanced per shift in development work.

STANDARDIZATION and EASE OF ASSEMBLY Vital in Roller Bearing Design

By P. C. POSS
The Timken Roller Bearing Company

FAST and efficient coal and ore haulage invariably is attained by use of anti-friction bearing equipped cars. Through the cooperative efforts of bearing manufacturers, mine operators and independent research institutions it has been possible to accurately determine the amount of power, grease and other savings through the use of roller bearing equipped cars. For instance, starting friction is known to be three times greater for plain bearing cars. Obviously this means that with roller bearings more cars can be started and hauled with the same power equipment; and in fact, many mine operators have been able to increase the number of cars per train as much as 50 percent after completely changing over to roller bearing equipped cars. A 50 percent increase in the number of cars means a 50 percent increase in tonnage from mine to tipple, a more economical use of locomotive power as well as labor used in operating the trains. Grease savings per pound per car usually run anywhere from 30 to 90 percent; 80 percent is not at all uncommon. The reduction in labor cost entailed in the greasing of the cars is probably closely proportionate to the saving in grease consumption.

Cognizant of these important advantages, mine operators, with keen competition demanding every possible mechanical aid, have rapidly anti-frictionized their haulage equipment. The Timken Roller Bearing Company alone has sold well over 2,000,000 tapered roller bearings for mine car service—enough bearings to equip more than 250,000 cars.

As a matter of fact the question of the suitability and acceptance of anti-friction bearings has largely given way to how they can be most effectively mounted to meet all service requirements. In this connection the very large extent to which tapered roller bearings are used has in itself created two important problems: (1) Standardization of parts, and (2) ease of assembly.

In mine practice, where the application of anti-friction bearings has

made the life of the wheel tread and flange the limiting factors in running gear assembly life, instead of the life of the axle, the standardization of bearing parts is especially significant. Extra parts are available since they may be carried in stock. Bearing parts which have been salvaged from worn-out wheels can be held in stock and later used for replacements. Furthermore, wheel replacements can be made without disturbing the axle assembly to any great extent. While part standardization is in itself a big step in the direction of ease of assembly, special care has been taken to keep the design of the mounting simplified so that the need for expensive machinery and highly trained personnel to assemble the parts is eliminated.

Both standardization and ease of assembly have received considerable attention in the development of assemblies used in connection with roller bearings. Several different types of mountings have been designed to meet different service requirements but all have two points in common. They are made up of standardized parts and are very easy to assemble. The different types of mountings include those for cars with through, extended and stub axle and journal box design.

Because operating conditions vary widely in different mines and because anti-friction bearing service and lubrication are closely related the Timken Roller Bearing Company stands ready to assist the operator in solving his particular lubrication problems. Hundreds of operators have availed themselves of this service and hundreds of bearing failures resulting from improper lubrication have been avoided.

Mining With Antifriction BEARINGS

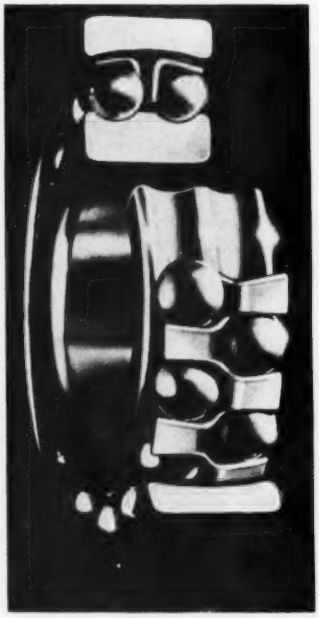
By ROBERT C. BYLER
S K F Industries, Inc.

LIKE the old mine mules which have practically passed out of the mining picture in favor of modern locomotives, so are plain bearings on mine equipment being replaced with antifriction bearings.

Practice has proved that too often a good machine is made useless by trouble due to poor bearings—that failure of a builder to consider the most suitable bearing in his design often means failure to the machine under service. For that reason, mine equipment manufacturers and operators alike are paying much more attention to bearing characteristics today than they did 30 years ago.

Antifriction bearings do not depend on an oil film to separate bearing surfaces. The load is carried by steel balls or rollers, which, in all high quality bearings, are manufactured from selected steel, hardened throughout, and ground to microscopic accuracy. The oil in an antifriction bearing cannot be squeezed out because it is not under pressure. It is used to protect the highly polished balls, rollers, and races. As the bearing revolves, it is thoroughly bathed in oil.

In antifriction bearings, there can be no sliding. In ball bearings, for instance, hardened steel balls are almost perfect spheres and roll on races of selected hardened steel—resulting in a virtually wear-proof bearing, accurate to a hair.



Because of all these characteristics, antifriction bearings require only a minimum of lubrication and give a long life of dependability. Yet in 1908 mine operators viewed the application of antifriction bearings to a mine locomotive motor with the same skepticism that greeted the first steamboat, telephone, motion picture machine, airplane and other notable inventions. True, the use of ball bearings had been successful on bicycles, roller skates, automotive, t e x t i l e, woodworking and a few other applications—but these were no criterion for the hard continuous service of coal mine operation.

That antifriction bearings passed that test with flying colors 30 years ago is evidenced by the fact that the same type of bearing is used on practically all mine locomotive motors as well as on other types of mine equipment today.

This particular type of bearing is known as the self-aligning, self-contained ball bearing. The inner surface of the outer race is spherical, thus enabling the bearing to compensate for unavoidable conditions of misalignment caused by frame distortion or shaft deflection without impairing its full carrying capacity.

When mine equipment manufacturers noted how it removed the danger of a stripped armature, or an oil-soaked commutator, they began thinking in terms of antifriction bearings for their other machines. Another important factor that impressed them was the ability of this bearing to hold a supply of lubricant sufficient for months of operation. The chamber that holds the bearing is also a lubricant holder. This greatly simplifies the lubrication problem because the ball bearing motor needs lubrication so seldom. Consequently, mine equipment manufacturers and operators alike began to experiment—and they found that new economies were available through the use of antifriction bearings.

These economies can be translated into the following bearing characteristics: (1) Antifriction bearings consume less power and are therefore more efficient; (2) they do not run hot; (3) they show practically no wear; (4) the lubricant is not forced out of the bearings, so they use very little oil. It should also be noted that it is very easy to house ball and roller

bearings in oiltight and dustproof enclosures.

Now let us see what these advantages mean to the mine superintendent who is looking for reliable equipment. More efficient machines mean money saved whether power is generated at the mine or purchased. With the price of producing coal steadily advancing, it is imperative to use every machine of proven efficiency. With rotating parts mounted on antifriction bearings, machines are efficient.

As on mine locomotive motors, so it is on cars, drills, cutters, loaders, pumps, fans—wherever machines take the place of muscle in the production of coal—antifriction bearings are writing a new chapter in low-cost performance.

Speeding the Wheels on BALL BEARINGS

By H. G. DILLON
New Departure

DURING the past few years there has come a realization by the mine car manufacturer that the initial cost of his product to the mine operator did not reflect a true over-all cost if economical and low-cost operating expenses were not embodied in his car design.

The anti-friction bearing engineer has, through a close cooperation with the mine car builder as well as with the mine car operator, developed bearings and installations that have not only reduced operating costs, but maintenance expense, to such a degree as to permit mine cars being operated today at a lower cost per ton mile than at any previous time in mine car history.

Figure No. 1 shows the cut open view of a completely sealed bearing that has recently been developed by one of the larger ball bearing manufacturers after years of study and practical experience in the problems involved in supporting rolling member under various conditions as found in mines today. This particular type of bearing is a self-lubricated, sealed-for-life unit. It is not subjected to misadjustment nor open to contamination of abrasives or dirt. (Being of the ball type, it is inherently the most frictionless, and consequently cars so equipped require less power to move.)

It is readily recognized that the most efficient haulage is that one in which the operator can haul the largest quantity of coal the most miles with the smallest capital investment in cars, and with the lowest operating and maintenance costs. In one of the largest mines using our equipment it was found that a 25-ton locomotive was able to pull without difficulty 80 cars equipped with the above described self-sealed bearings. We have a report on another mine, which was operating on a 24-hour basis six days a week, and where an 8-wheel car was carrying a total car weight of 16,000 lb. a distance of 54 miles a day, that this particular car has now been in operation for a period of two years without any maintenance expense. This performance, when applied to the average mine, would be equivalent to some 30 years of service, in view of the fact that this particular car is carrying an overload of approximately 50 percent. We have still another report from the general manager of one mine, where the cars are equipped with self-sealed bearings, which states that this is the first time he has been able to operate cars for a period of 1½ years without failure of a single bearing or wheel. These performances only reflect what has been true of many thousands of cars so equipped.

It must, however, be understood that such results can only be obtained through the cooperation of not only the mine car builder, but the mine car operator, and that the design developed must fit into such operating conditions as seam thickness, track gauge, type and length of haulage, existing equipment, length of life of mine, and shop repair facilities, if best results and efficient haulage are to be attained.

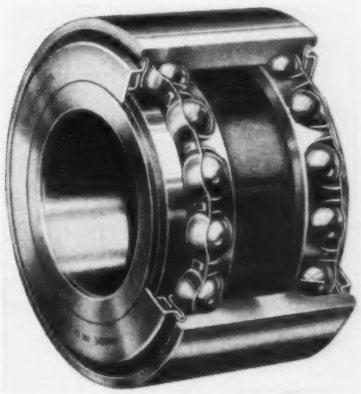


Fig. 1. Cut-open view of completely sealed bearing

Butte Highland Operating Successfully

One of the most successful of the newer operations in Montana is that of the Butte Highland Company, a few miles south of Butte. Under the efficient presidency of W. S. Norman, of Spokane, Wash., this company has been producing from $25,000 to $35,000 in gold each month. May, however, was a hard month, for storms were remarkably severe for that time of year, and mine and mill were shut off from the outside world for seven days and forced to close down. But as soon as the weather broke, operations were quickly restored and production in June started strong. In May, the output was only about $18,000.

Thunder Mountain Production

Thunder Mountain Mining Company, of Spokane, Wash., in six days in April milled 288½ tons of ore that averaged $10.62 in gold. A few days later the mill went into operation at full capacity, running approximately $10 a ton and handling 50 tons a day. A. H. Sperry, president, reports a recovery of 70 percent by amalgamation, and 20 percent by flotation, the flotation concentrates averaging about $800 to the ton. Bullion recovered by amalgamation is shipped to the United States assay office at Seattle, and the concentrates to the United States Smelting and Refining Company at Salt Lake. Bullion shipments run 600 to 625 fine in gold, and 350 fine in silver. Mr. Sperry reports a heavy tonnage ready for the mill, in a vein lying very flat. The property is in central Idaho at a high elevation and at one of the most difficult points of access. It was necessary to use planes last winter to reach the camp.

Vital Role of ELECTRICITY in Mining

By DONALD J. BAKER
Asst. Sales Manager
I-T-E Circuit Breaker Co.

WITH practically every company in the coal industry today busily engaged in planning or carrying out an extensive underground mechanization program, it is interesting to review the great progress that has taken place in the use of mining machinery since the early days of underground electrification. A short resume of the history of the first electro-mechanical applications gives a better background for appreciation of the vital role of electricity in mining.

50 Years of Mine Electrification

The year 1938 could well be termed the golden anniversary of electricity in mining, since electrically-operated machines first came into use about 50 years ago. It was significant that two of the most fundamental of mining operations—cutting and hauling—began their mechanized development about the year 1888. The first trolley-type locomotive to be used in a bituminous mine saw service that year, and the first motor-operated coal cutter was used the same year. Since then the development of each machine has paralleled the development of the other in attaining greater capacity and mobility. In 1889 the first motor-driven pump went to work.

But it was not until the turn of the 20th century that electrical developments underground began to come rapidly. In 1899 the first battery locomotive began hauling cars and the following year the first motor-operated reel for trailing locomotive cable was in use. The first AC transmission line was taken inside in 1901 to feed a 275-volt DC motor generator set. By 1902 booster generators were raising the voltage on the ends of long DC feeders in many mines. By 1905 most of the mines in western Pennsylvania had 250-volt trolleys and feeders installed. The first battery cap lamp appeared in 1908 and five years later purchased power had been generally accepted as superior.

In 1914 the industry could point to its first "completely electrified" mine. This was also the year of the first automatic reclosing circuit breaker, which introduced the semi-automatic substation to permit location of smaller and more numerous generators nearer the face. Beginning in 1920, full-automatic controlled motor-generator sets were available and the first mechanical loaders were being used. Pumps and fans turned full-automatic in control between 1923 and 1925. The first mercury arc rectifier substation was installed in 1927 and two years afterwards the first so-called "completely mechanized" mine of the industry was shipping coal.

What the improvements, within the memory of the present generation of engineers, have meant in greater production and lower costs, can best be surmised from the report of one fully-mechanized mine that now has 7,275 hp. of connected DC load alone. This is exclusive, of course, of its operations on the surface and in a modernized preparation plant. The steady pyramiding of power requirements will continue as more and more current is required to refine practices which still include labor operations of drudgery and inefficiency.

During most of the last two decades, the industry has contended with difficult marketing factors, which have been influential in a more rapid development of the completely-mechanized idea. An uninterrupted rise in rates for labor during this period hastened electrical applications in every direction.

Meeting POWER Needs by Improved RECTIFIERS

By D. E. RENSHAW
Mining Section, Industry Engineering Dept.
Westinghouse Electric & Mfg. Company

WITH growing mechanization of coal mines it is increasingly important that the power supply at the face be adequate, reliable and efficient. For many years, motor-generators and rotary converters were the only machines available for converting alternating to direct current and the choice between these two types was usually a simple matter, frequently determined by past practice on the property or in the neighborhood, and sometimes influenced by the value of power factor correction. The development and successful use of the ignitron rectifier has brought into the picture a third type of conversion unit, which undoubtedly has important advantages for certain conditions of service. It is the purpose of this article to indicate the conditions under which the ignitron rectifier may reduce the cost of mining coal.

Certain features are obtainable in all three types, as for example, automatic control, reliable operation, long life, and truck mounted portable construction.

Unfavorable Factors

The rectifier definitely has a lagging power factor of 93 to 95 percent over the normal range and cannot be used to correct for the lagging power factor of other parts of the system. In cases where the user's system power factor is very low, it may be best to use a synchronous motor generator set to earn the bonus frequently given for high power factor. This phase of

the problem should be carefully considered because, when incorrectly applied or operated, power factor correction may increase the system losses to over-balance the bonus.

The cost of a 275 volt rectifier equipment is more than the cost of rotating equipment of the same nominal rating. At 550 volts, the costs are approximately the same.

To most coal mining men the rectifier is a new and strange device which they fear will baffle their operators and repairmen. Experience has definitely shown that this fear is groundless. The operation and maintenance of a rectifier requires no degree of skill beyond that required for proper care of pumps, compressors and rotating conversion equipment.

Favorable Factors

The specially valuable features of a rectifier are its high efficiency and its ability to carry heavy overloads. How these may be evaluated is best shown by an example.

The underground equipment to be supplied with power from a new substation consisted of the following:

300-KW.
275-V. DC portable ignitron substation installed in western Pennsylvania coal mine

Quantity	*Machine*	*Approximate H.P. Capacity* 1 *Hour*	*Continuous*
2	10-ton locos.	300	120
6	8-ton locos.	360	156
6	Mobile loaders	300	120
6	Cutters	300	120
	Pumps	50	50
	Totals hp.....	1,310	566

This mine is fully mechanized; all these machines, except the haulage locomotives, are continuously working in a relatively small area which can be served by a single substation. Experience with similar operations indicates that, for this type of work, the maximum demand on the substation for a few seconds will frequently be equal to the total one hour rating of all of the motors served by the station. Therefore, the substation serving these machines should be of such capacity that the breaker can be set to carry a momentary load of 1,310 hp. without interruption of service. This is equal to 1,190 kw. at an assumed efficiency of 82 percent.

The breakers of rotating machines must usually be set to trip at not more than 2 times full load. Therefore, a 500 kw. rotating machine probably would be tripped off the line frequently, while the 400 kw. rectifier designed for this service can carry the momentary peak loads without an interruption in the DC supply.

The underground layout and organization of operations in this mine are such that the underground machines will be loaded to capacity in three shift operation. Therefore, the substation must be capable of supplying as much power as the cutters, loaders, etc., will take. However, since all the machines will usually not be carrying their maximum loads at a given time, a diversity factor of .75 can be applied in arriving at substation capacity. The average load is thus estimated to be 385 kw.

Since this is well within the capacity of the equipment, it is evident that a 400 kw. rectifier is adequate for the service, both in continuous and peak load capacity, and will supply power with fewer interruptions than would a 500 kw. rotating machine.

A comparison of losses indicates an average saving of approximately 24 kwh. for each hour of operation in favor of the rectifier over the entire load range. The DC trolley in this mine must be kept energized for an average of 21 hours per day or 7,760 hours per year. The total power saving is

$$7{,}760 \times 24 = 186{,}240 \text{ kwh. per year.}$$

At the minimum rate of 7.5 mills, this is worth $1,397 per year.

In addition, this difference in losses will affect the demand charge to the extent of

$$24 \times \$1.50 = \$36 \text{ per month,}$$

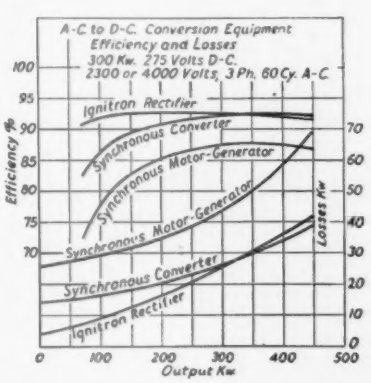
or $432 per year, making a total saving of $1,829 per year.

This saving is sufficient to liquidate the added cost of the rectifier equipment in slightly more than one year, taking into consideration, also, certain other cost factors of minor importance, which tend to balance out and not affect the final conclusion.

It is evident that, because of power saving alone, the Ignitron rectifier is the most economical conversion equipment for these conditions. This reduction in power cost, important as it is, may be of minor value as compared to the value of freedom from loss of power under normal working conditions. To operate this mine requires a large crew of men whose total wages are measured in dollars per minute. The saving of but a few minutes per shift is worth thousands of dollars per year.

This operation is, obviously, favorable for a rectifier application. But any other operation will be similarly favorable where

1. Freedom from power interruptions is very valuable.
2. The trolley wire must be energized almost continuously because of pumping load and multiple shift working.



HARRY F. BOE has been named manager of the service department of the Westinghouse Electric and Manufacturing Company, succeeding W. K. DUNLAP, assistant to the vice president, formerly in charge of the department, who has retired.

Mechanization has a strong ally in the development of the automatic mine car coupler. Safety, loading, haulage and dumping speeds have been greatly increased by this device

Keeping Step With Mechanization

By H. P. CHANDLER
Development Engineer
Ohio Brass Company

THE pendulum of modern mining has swung far in the direction of mechanization, and rightly so. For in mechanization, inevitably, lies the operator's answer to increased mining speed and efficiency and lower costs per ton. He must look to mechanization for insuring future profit margins.

Keeping step with, and trying to anticipate, the swift progress of mechanization has been the problem of the development engineer. Developments in mining materials at the Ohio Brass Company during the past year or so have all been directed to that end. Let us analyze a few of them.

With reference to new rail-bonding techniques, two new rail bonds, just introduced, emphasize the desirability of speed and convenience in mechanized mining. One of these is a wedge-type bond, consisting of the usual 2/0 or 4/0 copper strand and a semi-circular copper terminal designed to slip into a hole drilled in the web of the rail. A hardened steel pin, completing the circle, is then driven into the hole, wedging the terminal securely and resulting in a tight mechanical and electrical joint. The flat face of the pin is ribbed slightly to insure a positive grip on the copper terminal. Reclamation of this bond is easily accomplished by means of a few blows on the bottom of the terminal and pin, from the other end of the hole. Thus, the bond offers fast, easy installation and reclamation — meeting the demands of mechanized mining speed.

A portable, power-driven drill, adjustable for all weights of rail, facilitates drilling of the holes for the bond terminals, although rail can be ordered from the mill drilled to these specifications.

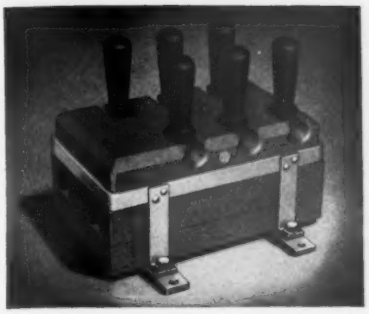
Another revolutionary bond development is the temporary mine set-screw bond, also especially designed for room work where frequent and swift installation and reclamation must be made. This bond is provided with set-screw terminals that embrace the base of the rail. A quick turn of the wrench on the heavy steel set-screw locks the terminal to the rail. The strand, lying under the base of the rail, is protected from injury. This bond, like the wedge-type, can be reclaimed almost indefinitely.

Improved Locomotive Headlights

New mine-locomotive headlights have been developed to facilitate accurate focus adjustment and better illumination efficiency. Three types of mechanism are available. One, an externally-operated mechanism, makes it unnecessary to remove the lens or open up the headlight in any way for adjustment of the beam. A special explosion-proof type, complete with explosion-proof resistance, has also been introduced for use in gaseous properties.

Combining safety and efficiency, a low-capacity, 300- or 400-ampere safety feeder switch for rooms and entries was also designed and built. Completely enclosed, this switch is of the quick make-and-break type and adequately protects the switch operator from burn and shock.

The simple action of a wedge is the secret of the installation and reclamation ease of this wedge-type bond



Recently designed multiple-cable junction, facilitating connection problems

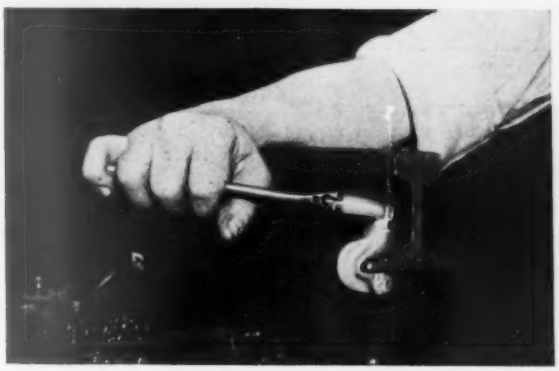
Meeting the heavy-current requirements of highly-mechanized mines, a heavy-duty section insulator switch has been developed. It is distinguished by heavy copper section and sturdy, foolproof construction.

Supplementing the O-B cable junction and permissible gasproof junction box is a newly-developed multiple-cable junction box offering easy connection facilities for two or more circuits. This junction box is expected to find general application in mechanized mines in locations where several circuits are in use at the same time.

New Automatic Coupler Increases Efficiency

It would be difficult to refrain from mention of the automatic coupler for mine cars and locomotives, when devices for aiding and abetting mechanization are discussed. Mechanical loading and dumping are greatly speeded up with this automatic coupling. Maintenance costs are slashed. Faster trips, smoother riding, and less loss of coal in transit recommend this device to the operator of a mechanized mine. Finally, safety is greatly increased, with the elimination of the necessity for men to go between cars for coupling and uncoupling.

In mechanization lies the future of profitable mining. With that knowledge in mind, it is not difficult for the development engineer to prophesy a continued searching for, and refinement of, devices, such as those above, dedicated to better mining methods.



Facilitating fast rail laying, this temporary set-screw bond can be installed or reclaimed with a twist of the wrench

Cutting Costs Through Use of Pressure TREATED TIES and TIMBERS

Presented by The Wood Preserving Corp. | E. I. du Pont de Nemours & Co.

LONG SERVICE RECORDS Prove TIMBER TREATMENT No Longer Experimental

By A. R. JOYCE
District Sales Manager
The Wood Preserving Corp.

THE force of changing economic conditions is directing the attention of coal operators to a new consideration of the selection of those materials used in construction, operation, and maintenance which will cut mining costs. Old standards, inherited methods, and rule-of-thumb practices which have governed timber use in coal mines are being critically examined. Successful results secured by other industries in lowering costs and increasing safety are being actively investigated. Wood, steel, concrete, and masonry all have a place in coal mining operations.

Wood has many advantages for use in mines. It has great strength for its weight. It can be sized easily to fit the conditions of use. It is resilient and absorbs impact readily. However, one of the objections to the average woods-run timber available for use in mines is its short life due to rapid decay. This objection can be entirely eliminated through use of chemically-impregnated timber which is durable and plentiful, whereas naturally durable timber is scarce.

The mining industry uses large amounts of wood as mine timbers and mine ties. Probably 90 percent or more of this timber is used directly in the mining operations for short periods of time and is generally abandoned

Treated timber in Olyphant shaft of Hudson Coal Co.

after the coal is extracted. Mines that still have available a plentiful supply of cheap native timber are fortunate as almost all the native woods are satisfactory for temporary use.

Long Life Timber Required in Main Headings

It is the 10 percent more or less of the total timber requirement that goes into the long-life main headings where the use of short-life native timber is unnecessary, because of the present availability of pressure-treated timber.

Mine ties and mine timbers treated under pressure with proper wood preservatives retain their original strength for long periods of time. The use of such pressure-treated timber in shafts, slopes, main haulage headings, and main air courses results in large savings since the labor cost of renewal is much higher than the usual material to labor ratio.

There are some 150 timber-treating plants in the United States, fully equipped to impregnate wood under pressure with creosote or toxic salts for the elimination of decay. Many of these plants, which were originally built to impregnate ties, poles, piles, and timbers for the railroads, utilities, and the construction industries, are well located to serve the mining industry.

Specifications which have been adopted by technical societies such as the American Wood-Preservers' Association, the American Railway Engineering Association, and the American Society for Testing Materials, have made standard the details of the impregnating processes and also cover the chemicals which are time proven in their effective prevention of decay—when properly used.

Service records of pressure-treated timber are voluminous. Millions of pressure-creosoted railroad ties, piles, poles, and billions of board feet of bridge and dock material are in service today in good condition after 20, 30, and more years of maintenance-free use.

Untreated main haulage ties costing from $.25 to $.40 each, which fail from decay in 2 to 5 years, are not economical to use when the labor cost of tie renewals is known to be from $.50 to $1.00 per tie, depending on the conditions in the headings. These calculations do not take into account the added safety of good track or the elimination of delays due to main haulage tie failures.

Hundreds of thousands of pressure-creosoted mine ties are now in use in main haulage tracks in representative coal mines for periods ranging up to 20 years. Current check inspections of the older installations show the timber to be sound and serviceable. This indicates that pressure-creosoted ties in mine tracks may be rated for life in a similar manner to the experience of the railroads in tracks on the surface.

Pressure-treated mine timbers have been in service in representative coal mines for many years. Where necessary, such timber is sized, dapped, bored, cut to exact length and branded for identification before treatment. Modern timber-treating plants are fully equipped with machinery to prepare the timber for use according to the requirements of the operator.

Dependable and economical main haulage track is secured by use of creosoted oak mine ties, 90-lb. rail, and cinder ballast at Vesta Coal Co. No. 4 mine

Treated Timber for Mine Car Bottoms

An interesting use of pressure-treated timber is for bottoms of composite mine cars. A number of mines have standardized on pressure-creosoted oak, both for new cars and for replacement of untreated bottoms in old cars.

The failure of untreated lumber formerly attributed to "mechanical wear" has not occurred when pressure-creosoted oak bottoms are used. Ten years of hard service and still in good condition shows that pressure-creosoted wood retains its original strength and is, therefore, adequate.

Combination Steel and Treated Timber Supports

Where head room prevents the use of treated-timber crossbars, steel beams supported on pressure-treated timber legs are often used in coal mines. Such use of different types of materials will frequently solve difficult problems.

An excellent example of the use of pressure-treated wood and steel in combination is found in the development of the AR-MOORED mine tie, which consists of a standard steel mine tie firmly bolted to a pre-formed, creosoted wood base. The AR-MOORED tie is designed for use in the working sections of mechanical coal mines where rapid car changes are essential and where good track that stays in line and surface is important. These ties also have the advantage of low-cost installation and removal, with heavy-duty capacity while in service.

The individual requirements of each coal mine must be studied before definite conclusions can be reached on the proper use of timber. In connection with such studies one fact is definite—the use of pressure-treated timber under ground can no longer be considered an experiment. Coal operators have available dependable standards for such pressure-treated timber and there is ample pressure-treating capacity available and conveniently located to supply the growing demands. The results of using pressure-treated timber for long-life service can now be viewed with confidence.

TIMBER TREATMENT Desirable From SAFETY Standpoint

By E. H. RIEMAN
E. I. du Pont de Nemours & Company

WITH the growing necessity for lower maintenance costs and increased safety factors in mining operations, the importance of economical timbering has rapidly come to the foreground.

In past years many mines owning timber lands disregarded treated timber because of the availability and cheapness of the wood. However, the clearing of nearby timber and the spread of treating plants throughout the country has made investment in treated wood for permanent construction desirable not only from the standpoint of cost, but safety as well. Meanwhile local timber is conserved for "temporary" uses such as room props, which are destroyed by crushing or mechanical failure at an early age, decay not being the primary cause. Such uses represent the major portion of the timber entering a mine and operators fortunate to possess local timber find it expedient to conserve it for this purpose.

In attempting to evaluate the importance of treated wood, its purpose and characteristics, will be explained in relation to maintenance costs.

A coal mine is normally a perfect breeding place for the conditions causing decay and deterioration of its own structure. Failure of ties, frame timbers, in fact all permanent construction in mines is almost invariably due to the damage caused by rot-producing fungi, parasitic forms of plant life lodged in crevices of the wood. Mine temperatures and humidity are favorable to their rapid growth while the wood on which they feed is available in abundance. Modern ventilating systems help distribute the spores throughout the mine, infesting each new installation. Under such ideal circumstances, fungous growth progresses rapidly.

Replacement costs in narrow, confined workings are high, and timber failures are extremely costly even when they entail no delay to operations, injury, or loss of life. Mine owners have taken the key from the railroads in accepting wood preservation as a necessary procedure. Service records of treated wood still sound after many years of continuous use justify their interest.

Life Span of Treated Timber 5 to 6 Times Untreated

Treated ties and timbers, as demonstrated by actual performance, have a life expectancy in excess of 15 years, outliving five to six untreated renewals. Reports made public by 27 important railroads covering a 24-year period disclosed a drop in tie replacements from 262 to 95 as the percentage of treated wood in use rose from approximately 10 to 83 percent. Untreated ties used by the railways, under conditions less susceptible to decay than in mines, average scarcely six years against records exceeding 25 years for ties given a preservative.

Underground mines are making use of treated timber for frame timbers, main haulageway ties, cribbing, lagging, reclaimable room ties, shaft timbers, air-course timbers, rock-dust barriers, stoppings, brattices, and mine-car timber. Above ground, preservatives are being applied to the lumber in building and tipple construction, foundations for buildings and machinery, railroad track ties and trestles, overhead bridges, and mine village maintenance.

Of the various types of treating materials, chromated zinc chloride has the following attributes: It retards fire in addition to resisting decay; it is odorless and safe to handle; it lowers the hazard of a haulageway blaze, usually spread by timbers, and its lack of odor prevents the adulteration of warning scents significant to miners. This product is an improved form of the long-established zinc chloride treatment which has been recognized for nearly a century. Its chief advantage over the older method is that it can be fixed more permanently to the wood fibre, giving longer and more enduring protection, especially in wet locations. For "salt" treatment such as chromated zinc chloride, treating specifications should call for a retention of chemical equivalent to three-quarters of a pound "dry salt" basis per cubic foot of timber. Pressure treatment is preferred to insure dispersion of the chemical throughout the wood structure.

Boriana Tungsten Mine Shuts Down

The Boriana tungsten mine, located at Yucca, Ariz., was recently ordered shut down by the New York officials of the Molybdenum Corporation of America, which is in charge of operating the mine, one of the largest tungsten producers in the United States.

Plans had recently been announced to initiate a full production program upon completion of the new mill under construction, which was designed to replace the one that was destroyed by fire last fall. The new plant was to have a considerably larger capacity than the one that was destroyed, and was to be ready to operate about May 1.

Whether or not the shutdown will be permanent is not known, but in view of the extensive developments leading toward enlarged production, it is thought that this is rather unlikely.

Four Coal Pioneers Honored

Four men who have aided in development of West Virginia's biggest industry will be honored this year by West Virginia University students in their Yearbook, the "Monticoala." It was recently announced by Editor Lynwood Creel, of Morgantown, and Business Manager Ned Shott, of Bluefield, that the annual will be dedicated this year to John Q. Dickinson, of Charleston; Jenkins Jones, of southern West Virginia; J. O. Watson, of Fairmont; and Joseph L. Beury, of Charleston. All of these men have played a very prominent part in the development of the South's coal industry in West Virginia.

Although the four operators chosen have been deceased for a good many years, Shott commented, "We feel their work played a major part in bringing the coal industry and the State to its place in industry."

Introducing "Capacity Factor" to MINE VENTILATION

By RAYMOND MANCHA
Manager, Ventilation Division
The Jeffrey Manufacturing Co.

IT IS the purpose of this article to introduce the term "Capacity Factor" as a preferable substitute for "Equivalent Orifice" when expressing the air-carrying capacity of a ventilation conduit such as an entire mine, a single aircourse, or any combination of aircourses.

"Capacity Factor" is defined as the volume (cu. ft. per min.) of standard density air passed by any conduit at unity water gauge (one inch). Obviously, "Capacity Factor" is a measure of the conduit's capacity and the name suggests the meaning.

"Equivalent Orifice," on the other hand, is arbitrarily defined as the area (sq. ft.) of a sharp edged circular opening in a thin plate that offers the same resistance to the passage of air as does the conduit in question. Consequently, instead of being a measure of the conduit's capacity, "Equivalent Orifice" merely compares the conduit's capacity with that of an orifice and fails to disclose the capacity of either.

Some, attempting a comparison between the section area and "Equivalent Orifice" of a conduit, become confused by the apparent contradictions encountered. They find it difficult, for example, to visualize a smooth lined duct 10 ft. high by 10 ft. wide and 1,000 ft. long having a section area of 100 sq. ft. and "Equivalent Orifice" of 144 sq. ft. On the other hand, to say that the same duct has a "Capacity Factor" of 360,000 c.f.m. is a direct statement of the duct's capacity at 1 in. water gauge which is not likely to be misunderstood by anyone.

Consider a mine or duct to be passing "Q" cu. ft. of standard density air per minute with a corresponding ventilating pressure of "P" in. water gauge. When expressing "Equivalent Orifice" (EO) in terms of volume and pressure it is necessary to include the constant 0.0004 in the formula $EO=\frac{0.0004Q}{\sqrt{P}}$. On the other hand "Capacity Factor" (M) is numerically expressed by the simple ratio $M=\frac{Q}{\sqrt{P}}$

If a mine or duct having a "Capacity Factor" of "M" cu. ft. per min., is to be ventilated with an air volume of "Q" cu. ft. per min., the necessary ventilating pressure "P" in. water gauge is numerically expressed by the formula $P=\left[\frac{Q}{M}\right]^2$.

If a ventilating pressure of "P" in. water gauge is available across a mine or duct with a "Capacity Factor" of "M" cu. ft. per min., the resulting air volume "Q" cu. ft. per min. is numerically expressed by the formula $Q=M\sqrt{P}$.

Fan Selection Made Easier

Fan selection is simplified by rating fans according to rated "Capacity Factor." The rated "Capacity Factor" of a fan is the volume of standard density air passed by the fan at unity water gauge (1 in.) when developing maximum ventilating efficiency. Therefore, having selected the make and type fan for operation at a particular mine, minimum power consumption will be realized with the size fan having a rated "Capacity Factor" most closely corresponding to the mine "Capacity Factor." This is true regardless of the volume of air desired.

Geometrically similar fans vary in rated "Capacity Factor" as the square of the fan diameter. Consequently a 10-ft. diameter fan has a rated "Capacity Factor" four times as high as a 5-ft. fan, etc. Many fail to understand why a larger fan is required to ventilate mine "A" with 100,000 c.f.m. at 1-in. water gauge than is required to ventilate mine "B" with 100,000 c.f.m. at 4-in. water gauge. The reason becomes clear when comparing the "Capacity Factors" of the two mines. The "Capacity Factor" for mine "A" is

$$M=\frac{100,000}{\sqrt{1}}=100,000 \text{ c.f.m.}$$

and for mine "B" is

$$M=\frac{100,000}{\sqrt{4}}=50,000 \text{ c.f.m.}$$

Obviously mine "A" requires a larger fan than does mine "B".

"Capacity Factor" of a conduit can be numerically expressed in terms of the conduit's length (L ft.), section area (A sq. ft.), perimeter (0 ft.) and friction coefficient (K) by the formula $M=\sqrt{\frac{5.2A^3}{KLO}}$. The overall "Capacity Factor" for a number of parallel conduits or air-courses is equal to the sum of the "Capacity Factor" of the individual conduits or aircourses. Consequently "Capacity Factor" is helpful when solving a ventilation problem involving complicated air circuits.

"Capacity Factor" Expressed in Familiar Units

The use of the term "Equivalent Orifice" needlessly complicates a fundamentally simple relationship that exists between volume and pressure. This relationship proves most useful when unaltered and, bearing the title "Capacity Factor" expresses the actual air carrying capacity of a conduit or mine at unity water gauge. Both qualitatively and quantitatively speaking, "Capacity Factor" is expressed in units familiar to mining men and engineers alike. It is therefore suggested that the adoption of "Capacity Factor" instead of "Equivalent Orifice" will be a decided step in the direction of simplifying the theory of mine ventilation both with respect to circuit analysis and fan application.

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L. B. HAMPTON, prominent in western business circles for a quarter of a century, has been made manager of the Pacific Northwest District of Crane Company, Chicago, succeeding F. A. NITCHY, who is retiring after 46 years service with the company.

DISLODGING COAL to Specifications

Presented by | American Cyanamid & Chemical Corp.
Atlas Powder Co.
Cardox Corp.
E. I. du Pont de Nemours & Co.

PERMISSIBLES—With Mechanical Loading

By H. I. PHEMISTER
Explosives Department
American Cyanamid & Chemical Corp.

SIMULTANEOUS with the 77 percent increase of mechanically loaded coal underground in 1937 compared to 1935, explosives manufacturers have been in step with the rapidly changing conditions by formulating permissible explosives primarily suited to mechanical loading.

With mechanical loading a new problem in blasting arose. The coal must not only be broken down, but a heaving out effect must be approached. In order for a loading machine to produce tonnage, the coal must be free from the face, otherwise valuable minutes will be spent in digging. The maintenance on machines forced to do the work the explosive should do would soon be a noticeable item on the debit side of the cost sheet.

With mechanical loading came multiple shifts and in some instances the necessity of loading out more than one cut from each working place per shift. For this speed work, the best of working conditions had to be maintained. Adequate ventilation alone was not the answer, but the necessity of explosives producing a small quantity of smoke and fumes was obvious. As soon as consideration was given to speed production with mechanical loaders, the idea of blasting with non-permissible explosives such as grain and pellet powder soon lost its place in coal blasting. The adverse working conditions created by the smoke and fumes from these explosives were not in line with the newer methods of dislodging coal. Screen tests in numerous mines have shown that the prepared size percentages of the non-permissible explosives can be equalled with permissible explosives when properly used.

Larger Cartridges Required for Proper Heaving

With mechanical loading the mine operators at once experienced trouble in preparing the coal in such manner as to facilitate easy loading. It was soon found that the old methods relative to hole placement and types of explosive were not suited to the new problem. Prior to the advent of mechanical loading, the common cartridge size of permissible explosives was 1¼ in. x 8-in. In order to concentrate the explosive charge properly at the back of the holes so as to develop a heaving effect, it was found necessary to adopt the use of larger sized cartridges. Permissibles in 1½-in. diameter are in common use at mechanical loading operations and in many instances diameters of 1¾ in. and 2 in. are growing in favor. In practically every instance where mobile mechanical loaders are in operation, except where long cutter bars are used in low coal, the use of the larger sized cartridge of permissible explosives has given improved results.

With mechanical loading came the necessity of explosives which produced a heaving effect. Exceedingly low rate explosives had never attracted much attention due to their insensitiveness in the smaller diameters. As soon as the larger diameter cartridges found a field of appreciation, explosives manufacturers began the development of low rate permissibles and advocated their use in the larger diameters. At present the U. S. Bureau of Mines list rates of detonation on permissible explosives as low as 4,900 ft. per second. These low rate permissibles are now the principal means of economically breaking down coal at the face. Low rate permissibles are manufactured in various densities ranging in counts from 80 to 170 1½-in. cartridges per 50-lb. case. In attempting to eliminate the necessity of using a half cartridge, the purchase of 1½-in. x 6-in. cartridges has become a common practice. In addition to saving time and explosives, this size has the advantage of offering increased water resistance when used in wet holes. The whole cartridges will not absorb water as rapidly as the broken cartridges.

With mechanical loading in low veins came the use of long cutter bars in order to increase the tonnage per fall of coal. Explosives manufacturers have met the call for low rate permissibles in smaller diameters in order to obtain bore hole distribution for some particular conditions. The manufacturers of permissible explosives now offer low rate grades with cartridge counts varying from 115 to 250 1¼-in. x 8-in. cartridges per 50-lb. case.

Advisory Service Developed

With mechanical loading came the necessity of mining engineers trained in the use of explosives to assist mine operators in their blasting problems. The manufacturers of explosives now carry a staff of these engineers who gladly assist on any blasting problem. Through the cooperation of these engineers with local mine officials, the blasting problems peculiar to many individual mines have been solved.

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WILLIAM ARTHUR has been appointed Philadelphia district office manager of Allis-Chalmers Manufacturing Company, succeeding the late J. E. Wray.

GREATER SAFETY Claimed for New Blasting Caps

By JOHN ROMIG
Technical Representative
Atlas Powder Company

PROGRESSIVE explosive manufacturers are continually working to increase the margin of safety for the user and to improve the performance of explosives. New demands and new conditions arising in industries using explosives are studied in laboratory and field so that safer explosives can be provided at lower cost per ton or per cu. yd. blasted.

In coal blasting, the so-called speed of an explosive often has been thought to be the only, or most important factor in producing a desired quality of coal. Actual field trials indicate that several other factors enter into the making of coal. Explosive strength and speed are, of course, important. Pressure and how it is developed, however, are getting more attention from explosives technicians.

Measurement of Pressure

The pressures that are required to move different seams of coal from their fixed position have been determined in a general way through the use of the American Cannon Gauge. This consists of a piston within a cylinder which, when actuated by the blast, compresses a small lead or copper cylinder. The amount of compression is indicative of the pressure developed.

Because of the many variables found in actual coal blasting such as tamping, kind of stemming, diameter of the bore hole, it is not an absolutely accurate measure of the amount of pressure actually required to move the coal. This method does furnish a close approximation and considerable effort has been made to formulate powders that develop the desired pressures.

Rate of Pressure Development Important

The rate at which pressure is built up by explosives, however, is a factor that is considered of increasing importance in coal blasting. Through the use of a pressure gauge in conjunction with a Bichel gauge charts have been obtained showing not only the maximum pressure built-up by an explosive but also the time required to build up the pressure. Considerable success has resulted in correlating this information with field results. With these things in mind explosives technicians are continually working to perfect blasting agents.

New Detonators Offer Greater Margin of Safety

An announcement of great interest wherever explosives are used is the development of the method of using what is known to the chemist as hexanitromannite as an initiating compound in blasting caps and electric blasting caps.

These new detonators sold under the trade name of "Atlas Manasite" give the user of explosives a much greater margin of safety without sacrifice of detonating efficiency. Careful tests—the falling weight test, sand friction test, the piercing test, heat and spark tests—indicate a substantial reduction of hazard in the common causes of trouble resulting from inadvertent mishandling. This means definitely greater safety in handling for the worker with explosives and far less chance of accident through handling by irresponsible people.

It should be emphasized that inasmuch as a blasting cap is designed and intended to set off high explosives, no blasting cap ever can be called absolutely safe. Safety precautions should never be relaxed.

However, men responsible for operations where explosives are used will welcome as tremendously important any development which makes safety precautions more effective and which should result in a noticeable decrease in accidents.

SPECIALIZED EXPLOSIVES SERVICE Aids Operators

By ALLYN HARRIS
President
Cardox Corporation

REQUIREMENTS affecting the "shooting" of coal have changed greatly in recent years. It is not uncommon to have specified in exact terms the type of fall required to best meet operating and marketing conditions.

Specifications may cover loadability for a particular type of equipment, the condition of the coal from the standpoint of hand or mechanical cleaning, and the coal condition best suited for current market requirements. They may also cover roof, rib, dust and visibility conditions. Variations may occur from time to time with changes in operating and marketing conditions.

Thus, the dislodging of coal has become an important and highly specialized phase of mining. Whether this is a result or cause of the development of specialized methods and equipment to meet these conditions is of relatively little importance. The important point is that such methods, equipment and skilled personnel have been developed to render this specialized service to the industry.

In this, as in other phases of mining, the emphasis should be placed on "skilled personnel" rather than on the particular product involved, as it is the intelligence, experience and service policy of the personnel back of a product that give it a major portion of its utility.

Through the years it has been the aim of Cardox Corporation to develop its personnel and its products to completely fulfill the industry's need for this specialized service in "Dislodging Coal to Specifications." Acceptance of this service has to date extended to more than 100 mines in nine states.

IMPROVED EFFICIENCY in Coal Mining Explosives

By U. J. COOK
E. I. du Pont de Nemours & Company

AN important achievement of the explosives industry in recent years in the manufacture of explosives for coal mining has been the development of new permissible explosives which produce a greater percentage of lump coal. This development has been recognized by the mining industry so quickly that these newer lump coal explosives have risen to an important place in the industry's consumption within the short period since they were introduced.

The action of black powder has always been practically ideal for lump coal production, but because of the danger of igniting gas it is not so good in this respect. For years the explosives industry has been producing explosives which meet the requirements of permissibility. Only recently, however, has the industry been able to develop a product which would meet the requirements of a permissible and also approach the slow-heaving action of black powder. To do this it was necessary to produce an explosive with a speed much lower than any previous permissibles. These new permissibles have a velocity of detonation of from 4,800 to 5,500 ft. per second as against 900 ft. per second for black powder. They have a slow, heaving effect, spread well as compared to other permissibles, and will not pulverize the coal immediately surrounding the charge to as great an extent as other permissibles. They can and do produce a good percentage of lump coal and but little bad fumes.

More Attention to Recommended Practice Urged

It has been conservatively estimated that careful attention to the explosive manufacturer's recommendations for drilling would save some mines 25 percent of their explosives costs, and still reduce pulverization. As a rule rib holes should be put a foot or more out from the side and often as much as 30 in. from the rib. So far as possible they should be parallel with the center line of the place. Few realize how great a percentage of the pulverized coal results from "gripped" rib holes. Attention to the alignment of holes will largely eliminate projections on the face and will probably permit the place to be shot with fewer holes. This means not only a saving in time and explosives, but also an improvement in the coal.

Must Tamp Properly With Slower Permissibles

Stemming and tamping are particularly important with these slower permissibles. In general, the slower the explosive, the greater is the tendency to blow out the stemming. Black powder, being the slowest of explosives, is most difficult to hold, and the new permissibles, being the next slowest, are almost as difficult. Proper stemming, however, will reward the operator in a reduction in blasting costs; and, of course, smoke, fumes and dust resulting from blown or partially blown shots will be lessened.

It can hardly be overemphasized that the efficiency, as well as the safety, of an explosive is bound up with not only the proper choice of an explosive, but particularly with the handling, drilling and stemming. With care exercised in this direction, it has been found that the new permissibles will produce a grade of coal approaching that which black powder can bring down.

Widening Field of HARD-FACING in Mining

By R. L. LERCH
Haynes Stellite Co.

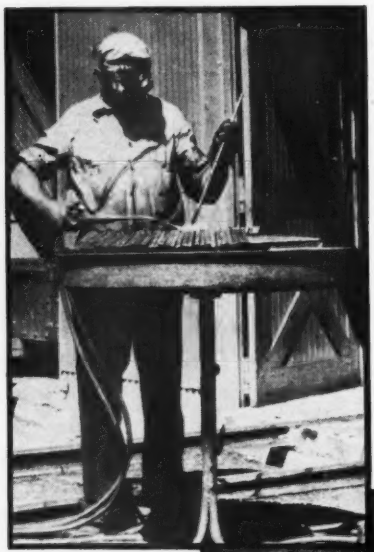
HARD-FACING—the method of protecting metal wearing surfaces with welded-on deposits of wear-resistant alloys—is employed extensively in both coal and metal mining operations. Equipment for drilling, excavating, crushing, pulverizing, and materials handling all operates more continuously, with fewer shutdowns, less lost time, and consequently more economy, when vital parts are hard-faced with abrasion-resistant materials.

When first introduced in the mining field, hard-facing was used to protect dipper teeth, scraper blades, bucket lips, and other parts of heavy-duty excavating machinery. These applications are now well known and widely employed as economy measures. Recently the trend has been in two directions. Alloys of the harder classes, such as cast tungsten carbide, are being used and tested on cutting and drilling operations, while the tougher alloys, composed chiefly of iron with certain alloying constituents, are being used on crushing, pulverizing, and screening equipment.

Where abrasion is high, but little or no shock or impact is encountered, the harder wear-resistant alloys, either the tungsten carbide diamond substitutes or cobalt-chromium-tungsten alloys, give the best results. However, when considerable shock or impact is present, the less expensive ferrous alloys are more suitable.

The proper choice of hard-facing material depends entirely on the type of service. As operators have become more familiar with the use of hard-facings, their better knowledge has been reflected in more successful re-

sults. An experience with materials used on the teeth and trimmer shoes of certain core drills illustrates this point. When hard-faced with an inexpensive ferrous alloy, these parts drilled about 2 ft. under the severe cutting conditions in one mine. When worn, they were rehard-faced with a non-ferrous alloy at only a slight increase in cost. However, this slight increase was more than justified by their much longer life. At a total refacing cost of about $5.50, they drilled from three to four times more footage than before.



Above: An ingenious fixture holding 40 coal undercutter bits while applying hard-facing material to each

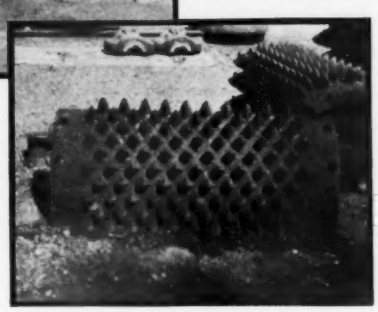
Life of Coal Cutter Bits Increased Greatly

Many of the more progressive mines have begun the practice of hard-facing coal undercutter bits with diamond substitutes. It has been found that bits coated with crushed tungsten carbide particles embedded in a strong steel matrix will cut many more times the tonnage of coal than bits hard-faced with other alloys. Several companies have had the pleasant experience of finding that bits so hard-faced last 25 times longer than ordinary steel bits. An appreciable power saving is also realized since the hard-faced bits stay sharp so much longer.

A recent survey shows that the average amount of coal cut between sharpenings of an untreated bit is but one ton, whereas the amount of coal cut per hard-faced bit runs from 9.8 to 10.2 tons—10 times as much. In addition, the survey notes a number of improvements in the performance of hard-faced bits: (1) savings in time for changing bits, (2) ability to cut harder places without changing bits, (3) lower cost of bit delivery underground, as the number of bits distributed is smaller per ton of production, (4) decreased cost of operating cutting machinery and savings in power, and (5) less fine dust in working spaces because the cutting edges stay sharper and cut, rather than rub off, the coal.

Left: Coal pulverizer hammers, the service life of which has been more than tripled by hard-facing

Below: Steel coal breaker segment ready for application of hard-facing material to tip of each tooth



Hard-Faced Breakers and Crushers

Non-ferrous cobalt-chromium-tungsten hard-facing alloys also are being used extensively for hard-facing coal pulverizers and breakers. Coal breaker segments of the type used by one coal mining company cost, when new, about $30. When hard-faced with this alloy, the teeth can be built up to their former size for about $11. Not only is there an appreciable saving in replacement expense, but it is also found that the hard-faced segments last several times longer than new parts.

In metal mines, the mantles, spiders, and concaves of gyratory crushers are faced with an alloy of chromium, manganese, and iron. They can be rebuilt to their former size with this alloy at only a fraction of their cost when new, and, when completed, in many cases last twice as long as when new. The economies of the rebuilding operation are found not so much in the longer life as in the much lower replacement cost. It has been found worth-while to rebuild crusher mantles when as much as 1,100 cu. in. of metal—over 300 lb.—has been worn away.

Unique Method of Applying Alloy to Grizzlies

Rock bar screens, or grizzlies, can be protected with a layer of hard-facing alloy along the top of each bar, and will last a long time without any difficulties. An unusual method has recently been developed to facilitate the hard-facing operation. The bars are separated and one at a time are supported on notched asbestos boards. Electrical contacts from a heavy-duty arc welding machine are then connected to each end of the bar. A heavy current sent through the bar heats it to a dull red. While the bar is kept hot by the current, cobalt-chromium-tungsten alloy is applied, by the oxy-acetylene process, along

Hard-faced augurs drill five times more footage between dressings, it is claimed

Note how hard-faced test bar, sixth from right, stood up compared with other unfaced bars of the grizzly

the top of the bar, in a layer about 1/16 in. thick. After they have been hard-faced, the bars are rewelded into their frames and are ready for service.

Small Amounts Produce Notable Results

Blades of dragline scrapers and of scrapers used underground are often coated with a layer of non-ferrous alloy ¾ in. wide. Protected in this way, they last from three to four times longer than before. Ore car coupler knuckles have also been hard-faced successfully. About 100 couplers can be protected with 1 lb. of non-ferrous alloy, and instead of lasting only two months, as they did at one mine before the introduction of hard-facing, they now last for over a year before refacing is necessary. Hard-faced shovels, too, are used successfully in loose earth.

Skip guides are economically hard-faced with a wear-resistant alloy. In one plant, ordinary skip guides lasted but 10 days; 2½ lb. of Haynes Stellite, applied to each of the four guides on each skip prolonged the guide life to three months. Hard-facing the horns on skip dumps is also standard practice at some mines.

Rabble disks, used in connection with roasting copper ore, are also economically hard-faced. At one plant, ordinary disks wore down from 18 in. in diameter to 11 in. in six months. After a similar period of service, however, disks protected by hard-facing alloy applied 1/16 in. thick and 1 in. wide around the outer edge, showed practically no discernible wear. Only about 1 lb. of hard-facing material is required to protect each disk.

Clamping dies, forming dies, drills, belt clips and rivets, latch bars, and many other small but important pieces of equipment are being hard-faced more widely.

While this is but a small cross section of the many uses for hard-facing in mines, superintendents of progressive companies are daily finding new successful applications. Hard-facing is being applied with very gratifying results to more and more parts where excessive wear is troublesome in causing frequent replacement, or where new part cost is a disproportionate fraction of maintenance.

CHALLENGING COMPETITIVE FUELS Through Quality Products

Presented by
The Jeffrey Manufacturing Co.
Koppers Rheolaveur Co.
Roberts & Schaefer Co.

MODERN COAL PREPARATION Answers Industry's Needs

By W. F. BARNES
Manager of Sales
Coal Preparation Division
The Jeffrey Mfg. Co.

IN considering any industrial installation the conservative management will analyze their conditions with four questions in mind:

(1) What is our raw material?

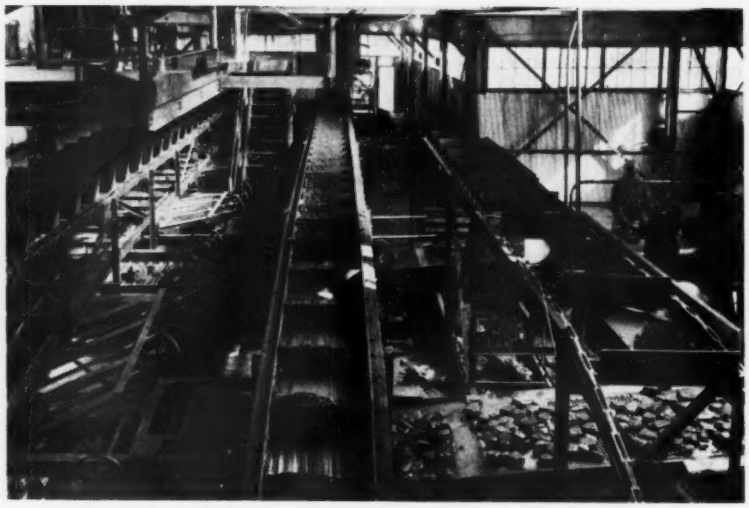
(2) What are our possible sales fields?

(3) What is our competition in these fields?

(4) What can we do to transform our raw material into a salable product which will satisfy the requirement of our logical markets and meet competition on a favorable basis?

For the coal producer these questions today cannot be answered in a brief article; but a broad general analysis of the problem will be of interest to many who are faced with the question of what to do.

Coal, we know, is the largest raw source of energy in solid form and may be laid down in the greater majority of markets at a lower price than other forms of energy. It has, however, in its raw form some features which penalize the purchaser, who is interested, primarily, in securing for himself the greatest number of energy units at the lowest possible cost, in-



Mixing and slack conveyors (over loading booms), with proportioning gates fully control loaded mixtures. Bone conveyor recirculates to crusher and washer to salvage laminated coal

cluding initial plant investment, upkeep and operation.

When one determines on the design of a boiler plant the question of first cost, when operating with coal, is complicated by the necessity of installing bunkers, conveyors, crushers, grinders and other handling equipment. Competitive fuels, such as gas and oil, require a minimum of accessory equipment.

From a standpoint of maintenance, too, the equipment handling coal must necessarily be of a type which requires more maintenance than that handling gas and oil. So only from the third standpoint of the cost of operation may the coal producer compete and hold his markets.

In operation, too, coal has its penalties—the cost of ash disposal, the disadvantages of fly ash and smoke from the stacks, the necessity of keeping clean the boiler and engine rooms from fine coal dust—all chargeable against operating cost. With all these penalties for the average power or heating installation—and they apply in lesser degree to the domestic market as well—it is little wonder that coal has lost many of its original markets and that the present day producer is deeply concerned with means to recapture them.

Recent Years a Renaissance in Mechanical Cleaning

Modern coal preparation, centering around mechanical cleaning and extensive arrangements for crushing, sizing and blending, is not a fad nor the bright thought of an energetic salesman. It is the answer to an industry's need—the need for a better product to meet competition. In the last few years the coal industry has had a renaissance of mechanical cleaning, impelled by the necessity of reduction in ash and sulphur, and aided by the development of effective equipment. This move has become prevalent throughout the coal fields of the country. The number of plants installed by our company doubled in 1936, and doubled again in 1937, and even today, at the low ebb of business, this field is one of the brightest from the manufacturer's standpoint.

Modernization Typified by Hickory Grove Plant

Having outlined the producer's problem it would be interesting to see how one operation has solved it. The Hickory Grove Coal Mining Corporation, near Terre Haute, Indiana, has recently completed an ultra-modern coal preparation plant. This is a strip mine operation, but the same principles of cleaning and blending are being applied by our engineers through all sections of the country.

The outstanding features of this plant are many. Passing over the run-of-mine shaker screens and the hand picking of egg and lump on counterbalanced picking tables, which are more or less accepted units, the main points of interest are the washing, dewatering, drying, blending and loading of the coal. The 4-in. x 0-in. coal is taken direct from the run-of-mine shaker screen and washed in a medium sized Jeffrey Baum Jig (at the rate of approximately 200 tons per hour) which effectively treats the unsized feed with good cleaning results down to the extreme fines. The development of this type of equipment, with its ability to handle unsized feeds, has resulted in great economies in plant construction, eliminating as it does the requirement for extensive presizing before cleaning with the attendant multiplicity of screens and cleaners. (Mechanical jigs have also been developed with the characteristics of the Baum operation to handle smaller tonnages).

In the Hickory Grove plant the washed coal is dewatered and sized on a special shaker type screen, the three larger sizes being discharged into a three compartment mixing conveyor and the fourth, a ¾-in. slack, into a parallel slack conveyor. Fine coal from the settling tank is recovered and mixed with this slack. These four

Control room surveys seven loading tracks, with full control over railroad cars and booms as well as plant units

sizes are conveyed up and over the loading booms with discharge gates, hand screw operated, providing for proportioned loading of any size or mixture of sizes on any track. The accompanying photographs give a good idea of the three compartment conveyor and the arrangement of mixing facilities. This arrangement gives the maximum in blending facilities without the investment and penalty of bin storage, and is perfectly adapted to this company's operation.

For winter operations, or for those customers who demand a dried product, the slack may be separated, taking out the minus ⅜-in. material, which is dried in a centrifugal dryer, or for extreme cases either or both the centrifugally dried product and the ⅜-in x ¾-in. may be passed through a heat dryer which will reduce the surface moisture to approximately 2 percent.

Centralized Loading Control

The loading operations are controlled by one man, in a control room where are conveniently located all controls for the car retarders, loading booms and other tipple units. This centralized loading control, with the ease of variation in mixtures and sizes, has enabled this plant to easily meet unusual specifications in the proportioning of the stoker and smaller sized coals.

That coal can compete with competitive fuels, regain lost markets, develop new uses and new markets, has been proven by those operators who have been willing and able to build preparation plants designed to convert raw material into a carefully prepared, salable product. New volume of sales, minimizing of dealer and customer complaints, utilization of lower quality reserves, increase in profit realization throughout the whole coal mining operation, are the products of proper preparation plant design.

Producing Cleaned Coal With GREATER UNIFORMITY

By JOHN GRIFFEN

Koppers Rheolaveur Company

THE principal competitors of solid fuel—oil and gas—are characterized by a high degree of uniformity in qualities. These fuels from a given source of supply can be depended upon to be fairly constant in physical and chemical properties and thus lend themselves readily to use with little necessity for adjustments to equipment to compensate for variations in the qualities of the fuel itself. Bituminous coal as produced from a mine is subject to far greater fluctuations in qualities which affect its use, such as size consist and chemical and physical properties. These variations are due to those of the coal seam and the many added variations produced by the mining operations.

The modern coal preparation plant has been designed to take this variable mine output and manufacture it into a product or products, quite constant as to size consist and in chemical and physical properties such as ash and sulphur content, heating value and ash fusion temperature. This greater uniformity, as well as higher average quality, is shown in the product car by car, hour by hour and day by day.

Developments in Size Control

To control size consist, the modern preparation plant is equipped with efficient screens to separate the mine output accurately into, usually, from five to seven primary sizes, with mixing conveyors and blending devices by which any or all of these sizes are recombined in fairly well controlled proportions. A further refinement is the use of bins for several individual sizes from which they are drawn in controlled proportions to produce shipments of definite and predetermined size consist.

To balance the production of run-of-mine coal to the market demands as to size, many preparation plants contain crushers to reduce unwanted larger sizes to those in demand. Crushers have been developed which afford a fairly precise control of the size consist of the crushed product. To afford even greater control screens are installed to rescreen the crushed coal.

Greater Advances in Mechanical Cleaning

Parallel with this development in the control of size consist, greater strides have been made in the development of mechanical cleaning equipment for the removal of refuse materials and close control of the ash and sulphur content, heating value and the ash fusion temperature of the coal. Also effort and care have been devoted to testing the output to determine how closely this greater uniformity in these qualities has been attained.

The type of mechanical cleaning equipment used has a decided influence

Table I. Variability of ash content of raw coal and cleaned product from Rheolaveur cleaning plants, car by car

	Illinois - Strip Mine Coal					
Size of Coal	1-1/2" x 0"		1-1/2" x 1/4"		1/4" x 0"	
Type of Coal	Raw	Cleaned	Raw	Cleaned	Raw	Cleaned
Number of Cars Sampled	396	110	417	287	155	108
Ash, Dry Basis, percent:						
Average	14.48	5.02	10.94	4.44	21.86	4.05
Maximum	28.45	9.28	27.62	8.96	33.40	5.93
Minimum	6.76	2.47	4.03	2.40	10.78	2.59
Probable Error	2.25	0.79	2.14	0.68	2.46	0.51

	Pennsylvania - Pittsburgh Seam Underground Mines				
	Plant C		Plant D		
Size of Coal	1-1/8" x 0"		4" x 0"		
Type of Coal	Raw	Cleaned	Raw		Cleaned
			Before Bins	After Bins	
Number of Cars Sampled	100	100			2410
Number of Samples			120	102	
Ash, Dry Basis, percent:					
Average	11.90	8.20	10.40	10.20	6.00
Maximum	18.00	10.10	24.20	14.00	8.00
Minimum	8.20	7.00	6.70	7.80	5.00
Probable Error	1.36	0.36	1.53	0.86	0.14

Buckhart coal preparation plant, one of two such plants of United Electric Coal Cos., designed and erected by Koppers-Rheolaveur Co.

on the uniformity of the product. The Rheolaveur process of launder washing, which is unique in containing the feature of recirculation of an intermediate quality product, has shown clean coal of unusually uniform analyses as well as very efficient cleaning. This method of utilizing an intermediate quality product gives a regulating effect like a flywheel, so that variations in the raw coal qualities are smoothed out in the cleaned coal. This uniformity of Rheolaveur cleaned coal is particularly evident when judged by car to car results.

The data given in Table I are typical of the improvement in uniformity shown by preparation plants equipped with Rheolaveur cleaning units treating a diverse variety of American coals. These comparisons are based on car samples and show that the variability of the cleaned coal has been reduced very materially, being from one-third to one-sixth of that of the raw coal.

Some explanation of the term probable error may be in order. By definition, the probable error is the value of the plus-and-minus limit from the average value within which 50 percent of the results will fall, and the probable error, "r", denotes the distribution of analytical results as given in Table II.

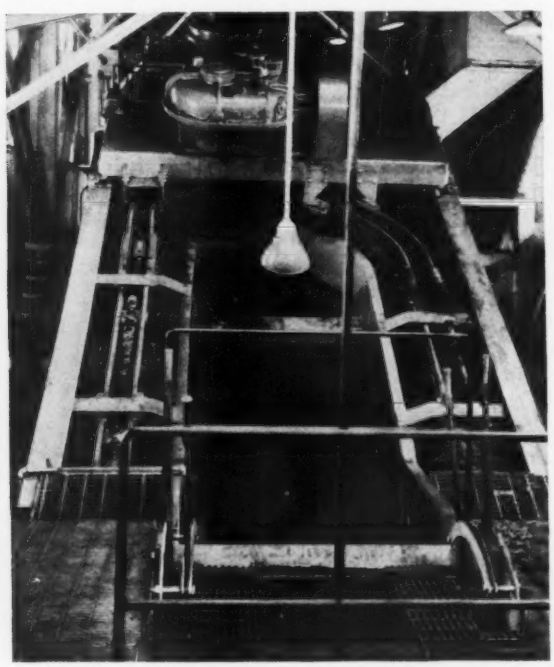
TABLE II—VARIABILITY OF COAL DENOTED BY PROBABLE ERROR, "r"

Limits	Percentage of results
Average ± r	50.0
Average ± 2r	82.3
Average ± 3r	95.7
Average ± 4r	99.3
Average ± 5.7r	Expected once in 10,000 results

Taking the data in Table I, Plant D, as an example, the limits of ash content within which the raw coal, after bins, and the cleaned coal should fall are shown in Table III.

TABLE III—VARIABILITY OF ASH CONTENT OF RAW COAL, AFTER BINS, AND CLEANED COAL, PLANT D

	Limits of ash percent, dry basis	
Percentage of results	Raw coal after bins	Cleaned coal
50.0	9.34–11.06	5.86–6.14
82.3	8.48–11.92	5.72–6.28
95.7	7.62–12.78	5.58–6.42
99.3	6.76–13.64	5.44–6.56
Once in 10,000 results	5.30–15.10	5.20–6.80



Rheolaveur coarse coal washing unit. Here thousands of gallons of water (three tons per ton of coal) float the coal down a wide trough, while impurities sink and are removed

This illustration clearly shows how cleaning the coal in Rheolaveur equipment has, in addition to reducing the average ash from 10.20 percent to 6.00 percent, reduced the variations in individual car analyses to extremely low figures. Thus only once in 10,000 cars should one car analyze lower than 5.20 percent or higher than 6.80 percent ash.

This greater uniformity in ash is

directly reflected in a like improvement in uniformity of heating value. The above raw coal shows that 99.3 percent of the results may be expected to fall within a variation of plus or minus 3.8 percent of the average heating value or a total range of 7.6 percent which means a range of about 1,000 B.T.U. per pound. With the cleaned coal 99.3 percent of the results should fall within a variation of plus or minus 0.6 percent of the average heating value or a total range of 1.2 percent which amounts to only 167 B.T.U. per pound.

The greater uniformity in sulphur content is shown in Table IV. In this case analyses were made on samples representing a day's throughput. It will be noted that probable error of the sulphur content has been reduced by cleaning to about one-half that of the raw coal.

TABLE IV—VARIABILITY OF SULPHUR CONTENT OF 4" TO 0" RAW AND CLEANED COAL FROM THE PITTSBURGH SEAM, PLANT F

	Raw coal	Cleaned coal
Number of days sampled	351	353
Number of increments per day	16	32
Weight of each increment, pounds	375	375
Weight of original sample per day, pounds	6000	12000
Sulphur, dry basis, percent—		
Average	1.6165	1.2570
Probable error	0.0818	0.0440

The cost of preparing coal in this manner is very moderate. The cost figures following are for the entire preparation plant and include dumping raw coal, sizing, crushing, loading, laboratory control and refuse disposal and in some cases mechanical and heat drying, as well as the cleaning of the coal. Actually the costs for cleaning alone are but a small fraction of the total cost. Representative direct operating costs, including all maintenance charges, will vary from four to eight cents per ton depending upon the elaborateness of the preparation processes other than cleaning and the hourly tonnage handled.

Rheolaveur equipment lends itself to low cost cleaning as the capacity per unit can be made very large. A coarse coal unit treating 4-in. 5-in. or 6-in. x 0-in. coal handles up to 500 tons per hour, while a fine coal unit, cleaning 5/16-in. x 0-in. coal, handles as much as 150 tons per hour.

The ability to clean coal so cheaply, to improve its average quality and, more particularly, to increase its uniformity in quality, offers an effective weapon to the bituminous industry to combat the competition of other fuels.

"GOOD HOUSEKEEPING" in Cleaning Plants

By RAY W. ARMS
Roberts and Schaefer Co.

Cleanliness of the Negley dry cleaning plant of Pittsburgh Coal Co. is attracting widespread attention

A THING of beauty is not only a joy forever but often of the utmost utility. Such a mundane "thing" as a coal cleaning plant may not have the aesthetic appeal of a Rembrandt painting, but it will either arouse the admiration or the dismay of those who view it, depending on whether or not it is orderly, clean and roomy.

The time was when a coal washer was synonymous with a sloppy mess and dry cleaning plants bespoke clouds of dust inside and out. It became the duty of the designer and builder of such plants to provide equipment, at not too great a cost, which would hold water in the one case and suppress dust in the other. There are many modern, well-built washers and dry cleaning plants now definitely proving the fact that the manufacturers have supplied this need.

Better Operations Through Habitable Surroundings

The utility of this improved design has far exceeded the expectations of the most sanguine. It is a notable fact that the cleanest cleaning plants are producing the cleanest coal. The reason for this is the better operation automatically secured when the surroundings are habitable for the operator.

Coal cleaning equipment has not reached the advanced state of development of the modern automobile which requires only an occasional request from the driver to "fill 'er up" to keep going for thousands of miles. On the contrary, cleaning plants need constant and intelligent attention to keep pace with all the variables inherent to the problem of coal cleaning. The best designed, most expensive cleaning plant ever built can utterly fail in the hands of a careless operator.

It is not especially remarkable that the more orderly plants show the best operation because it is psychologically impossible for a man to do his best work in uncomfortable surroundings.

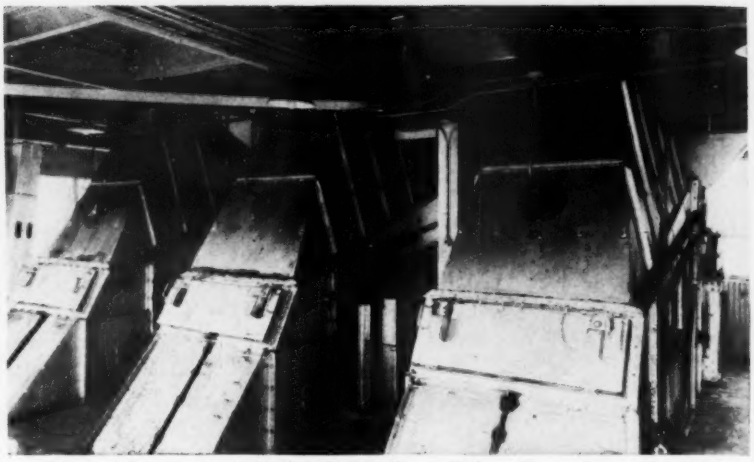
There is a fascination in the problem of coal cleaning comparable with golf or fishing and if uncomfortable impediments are removed you will find the enthusiasts discussing nothing else for hours on end. You have only to

provide the proper environment for such single-mindedness and the inevitable result is progress.

Notable Effect on Buyer

In speaking of the psychological aspects of the situation we should not neglect the impression a clean and well-kept plant has upon the visitor from the sales department or the buyer himself. When the cleaning plant justifies pride of ownership it is certain that sales talks can be made with convincing enthusiasts. After all, coal cleaning is an expedient to sell more coal rather than to raise prices. If a layman, whether he be a salesman or a buyer, leaves a cleaning plant with a good impression of its *appearance* he will naturally assume that the technical accomplishments of the plant are of the same superior quality and will go forth and spread the doctrine according to his conviction.

The coal industry can best challenge competitive fuels by producing a uniformly clean coal. The apparatus used for cleaning coal has been developed and improved to this end until now it is possible to secure remarkable technical results with modern equipment. The greatest challenge of all lies within the powers of the operators themselves and that is the policy of providing sufficient capital to install this modern equipment with the proper accessories so that the cleaning plant becomes an agreeable place in which to work and to visit.



Stump airflow cleaners in Negley plant produce a high quality product, and assure clean and habitable surroundings

No single invention or development can ever have the far reaching effect of this universal policy towards improving the quality of the industry's product.

The Manufacturer's Role in SAFETY

Presented by | Mine Safety Appliances Co.
Portable Lamp and Equipment Co.

CONSTANT RESEARCH Produces Results

By JOHN T. RYAN
Vice President and General Sales Mgr.
Mine Safety Appliances Co.

MINE safety is of considerable interest, not only to the manufacturer of safety equipment as such, but also to the manufacturer of any type of mining equipment. Today, safety is so important to the mine operator that the design and performance of mining equipment are examined carefully to determine their merit from a safety standpoint and as to what new hazards may be encountered in the use of a particular piece of mining equipment. Safety can no longer be neglected as a major factor in the design and use of mining machinery and, in fact, has become an important selling point in the presentation of such equipment to mine operators.

Machinery Has Eliminated and Added Hazards

The manufacturer of mining equipment must assist the mine operator in making his mine safe, because machinery is today of greater importance to mining than in any previous period. This element of machinery has been added to the factors with which the operators must contend in their attempt to make mining safe. Previously, the major problems were those of educating and supervising the individual miner and giving close attention to the natural hazards, such as roof conditions and the presence of explosive gas. Now, to these, machinery has been added. This increased use of machinery in mines has contributed much to the elimination of previous

hazards, but it must be kept in mind also that new hazards have been added at the same time.

In most of our coal mines, for example, methane has always been present. The primary danger at one time was the ignition of this gas by means of open lights. With the development of permissible electric cap lamps, this source of ignition was removed and as a result explosions from this cause fell off remarkably over the last 20 years. The increasing use of electrical machinery in mines has required the development and use of permissible electrical equipment, so that gas ignitions from this source can be prevented.

In rock work, particularly in metal mines, the introduction of modern compressed-air drilling equipment did result for a short time in a greatly increased amount of dust generated by drilling operations, as compared with the old hand-drilling methods. Development proceeded, however, on this equipment and facilities to permit wet drilling were introduced and now are generally used. In addition, to meet the dust hazard, permissible dust respirators have been developed which are not only efficient but also comfortable to wear. These are but two instances in which the introduction of machinery to mining may have for a short time increased the hazard, but soon the manufacturers met this problem by new devices or improvements.

What the net results of this increased mechanization of mining will be depends in large measure upon the attention given by equipment manufacturers to the problem of safety in their machinery. This matter of safety must be considered, not only from the standpoint of the design and construction of the machinery itself, but also as to the probable hazards that would be created by its actual use in mines. To a great extent, safety has been given its proper consideration in the design and use of new equipment, but it must not be forgotten that every new piece of equipment brings new hazards which require attention.

To the manufacturer of safety equipment, the major problems are the design of new equipment to meet existing hazards, to anticipate developments in mining practice that result in new hazards, and to improve existing safety equipment to make it more useful in the face of present-day demands.

Important safety developments are obtained only through careful research by manufacturers in laboratories such as the above of the Mine Safety Appliances Co.

Theoretical and Practical Research Necessary

Such problems call for research. It must be research on a wide-spread scale, comprising not only the theoretical but the practical, and requiring a background of experience in the specific problems of mine safety to avoid impractical ideas and wasted effort. The entire field of research, both fundamental and applied, moves at a rapid pace in these days, and the manufacturer must keep abreast with new developments in this field which will influence his own. Only in this manner can he hope to meet the new demands that are being imposed upon him with every advance in mining. Much of his research efforts may be devoid of any results for a considerable period of time, but this must be expected. The continued development and improvement in mining equipment over the past few years is convincing evidence that sound research does lead to practical results.

Examples of Research Results

Some specific achievements in the application of research to safety in mining may be mentioned. Foremost of these are the development and widespread use of permissible explosives underground, the increased illumination afforded the miner by the improvement in electric cap lamps from a few candlepower to 66 candlepower, the increased use of permissible electrical equipment in coal mines, and the development of methods and machinery for the proper application of rock dust to prevent disastrous coal dust explosions.

None of these advances in mine safety has come about through any sudden discovery, but rather through a steady series of improvements and adjustments to new conditions. Back of these, of course, is a long history of laboratory and field work that was required before the new products ever saw the market. In all of this work, scientists, designers and engineers play their part, since their expert services are required to solve the many technical difficulties that arise in the development of new equipment. It is difficult today for one man to sit down and design new equipment or improve existing machinery without such technical assistance unless he should have an extremely broad and intimate knowledge of chemistry, physics, mechanics, metallurgy and engineering. Organized research is necessary to furnish an answer to problems.

Hard hats and electric cap lamps are standard safety equipment in many large coal and metal mines

Mining has been made safer through the close attention given by the manufacturer to safety in all equipment that he produces. Mining is not in a static condition, and it cannot be expected that equipment adequate for today's needs will be applicable tomorrow. Continued advance is called for, and it is necessary that the manufacturer always keep safety as a foremost consideration in the design of equipment so that new hazards may not be added to mining as old ones are reduced.

SAFETY CLOTHES Minimize Head, Eye and Foot Injuries

By GEORGE C. NELMS

President
Portable Lamp & Equipment Co.

THE manufacturers' contribution to greater safety and health in mining during the past quarter of a century has been noteworthy from the standpoint of a reduction in both gas and coal dust explosions in coal mines, and fires in both coal and metal mines. These decreases, for the most part, have been brought about by the introduction of permissible electric cap lamps underground, the rockdusting of coal mines and the installation of more efficient ventilation equipment.

The most remarkable results have been and will continue to be obtained by those companies in which management not only accepts the responsibility for safe practices but sees to it that the safety rules and regulations are enforced and obeyed by the entire organization, from the president all the way down the line to the humblest employe.

Falling or Flying Objects Principal Accident Cause

Today, the major cause of fatalities in both coal and metal mines is due to falling or flying objects, with haulage accidents a secondary and sizable factor. While the manufacturers' role is to continue to push the adoption of safe and better underground illumination, and more efficient ventilation, greatest attention today is being given to the development of personal protective equipment for reducing head, eye, lung, and foot hazards, and mechanical devices for coping with haulage accidents.

Mine accidents are costly experiences and astute operators realize that improved safety records are not only desirable from the humanitarian standpoint, but they effect a considerable savings in operating expenses.

Suppose, then, that we study the statistical records on fatalities and injuries and consider the equipment which is available for combating these major causes of accidents underground.

According to U. S. Bureau of Mines statistics, approximately 60 percent of the fatalities in coal mines and 40 percent of the deaths in metal mines are due to falling coal, roof, rock, or ore. Moreover, about 20 percent of all underground non-fatal injuries in metal mines are due to falls of rock and ore.

Falling and flying objects cause three principal types of accidents—namely, head, eye, and foot injuries. To combat these hazards, manufacturers during the past decade have made rapid improvements in the development of safety caps and hats and protective clothing. Today, thousands of miners are wearing protective caps and hats, goggles, respirators and safety shoes. Innumerable testimonials are available to show where these inexpensive devices have actually saved lives and minimized injuries. Moreover, the Pennsylvania Compensation Rating and Inspection Bureau allows substantial premium credits among companies of its assured where these protective devices are worn by the miners. These credits are based upon an allowance of so many cents per hundred dollars of payroll.

Greater Attention to Haulage Safety Devices

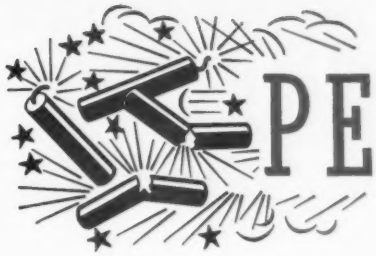
Scientific research is also being employed by certain safety equipment manufacturers in the development of haulage safety devices. During the past few years, car stops, skids and derailers have been introduced in certain mining operations in an effort to reduce accidents caused by loaded as well as empty cars, out of control, and by run-away trips. Companies employing these inexpensive devices are experiencing a definite decrease in haulage accidents and noteworthy improvements have been made by manufacturers of these haulage safety devices in recent months.

In these days of keen competition in the mining industry, a decrease in the cost of fatalities and injuries may be the deciding factor in keeping operations on the profit side of the ledger. Substantial savings in the high cost of accidents can be effected, and demonstrated beyond doubt, when mine management decides that safety takes precedent over every other consideration in mine operation policies and practices.

Illinois Mineral Industries Conference

The sixth annual Illinois Mineral Industries Conference will be held next fall on Friday and Saturday, September 30 and October 1, at the University of Illinois, Urbana. This conference is sponsored by the Illinois State Geological Survey, the Engineering Experiment Station, and the Illinois Mineral Industries Committee. Preliminary plans for the conference call for two major symposia, one on the future energy minerals and the other on new frontiers for the use of industrial minerals. A complete exhibit on the research work which is being done at Urbana is being planned for the information of the mineral industries of the State.

A preliminary program will be issued some time during the summer, and in the meantime inquiries regarding this conference may be addressed to Dr. M. M. Leighton, Chief, State Geological Survey, Urbana, Ill. October 1 will be Legionnaire Day, in connection with the football game between Illinois and Depauw University. Hotel reservations should therefore be made at once.



PERMISSIBLES

You can make fun of the Congress if you want to, but anybody that can spend $12,000,000,000 in 24 weeks isn't to be laughed at. . . .

■

One thing you can be sure of is that in those WPA movies, the extras in the mob scenes will be brandishing shovels instead of spears. . . .

■

Congressman Havenner of California handed back to the Government the $1,200 allowed him for traveling expenses with the explanation that he didn't use it, having gotten an equal amount for the special session. . . . No one got hurt in the rush to follow suit. . . .

■

The following is an Associated Press dispatch from Phoenix, Arizona. . . . "Police were asked today by a worried citizen to investigate a 'suspicious character who has been sitting on the curb all morning.' A radio car rushed to the scene. Upon their return to the station they made this report: 'Man is O.K., working for WPA.' "

■

In the old country the dictator's press agents call it a "conquest." . . . Out west in the mining country it's called "jumping a claim." . . .

■

You can brag about science if you want to, but to most of us science won't have accomplished anything until it prolongs human life to the point where the generation running up the debt lives long enough to pay it. . . .

■

One of Washington's best stories is that about the Congressman who tried to frank his piano home free through the mails. . . .

■

There's many a poor preacher that would like to get paid at the rate the Senate chaplain was compensated this session. . . . He gets $1,680 a year and says a prayer at the opening of each legislative day. . . . Parliamentarily speaking, the Senate had only three legislative days during the six months it sat. . . . Thus, the chaplain said only three prayers . . . at the rate of $560 per prayer. . . . You'd think the Senate didn't need praying over! . . .

■

The best short verse of the month—

" 'I see there will be no reprisals,'
"The honest old Senator said;
" 'I've Washington's promise,' he stated
"As the tomahawk sank in his head."

■

Any study of pump priming is bound to raise the old saw about sending good money after bad. . . .

■

The Government can regulate the stock market all it wants, but many a man is still getting burned picking up hot tips. . . .

■

And then there's the Georgia tobacco farmer who got so mad because his acreage was reduced by the AAA that he threatened to join the Republican Party. . . . Now, suh, you caint grow terbaccy in Maine or Vermont. . . .

■

It's now extremely doubtful if national labor leaders will again use the Speaker's quarters as an office from which to attempt to instruct congressmen how to vote on a bill in the next Congress. . . .

■

A questioner wants to know why it is necessary for the Congress to hold a session each year. . . . They're getting in practice for the time when they'll have to sit steadily to repeal the laws they have been passing recently. . . .

■

The average Congressman doesn't hesitate to tell the home-town voter how he alone successfully got through an important bill, but the records show that one-third or more of all members fail to vote on major legislation. . . .

■

Henry Ford favors a back-to-the-land movement in America. . . . Well, you could do worse than live on parity-payment and soil-conservation checks that farmers get nowadays for not farming. . . .

■

And another good subject for a fireside address would be an explanation of why the "liberal" Frank Hague is retained as national vice chairman of the Democratic Party. . . .

■

Foxy, these New Dealers . . . Between wages and hours, social security and income tax, it's going to take a lot of extra employes for taxpayers to make out the necessary reports to the Government. . . . Just a new way to increase employment. . . .

■

One question now bothering the Washington bright boys is whether the Government must comply with the wages and hours standards. . . . Now that it's the biggest employer in the world, the Government may find difficulty in meeting pay rolls. . . .

■

The Senator who remarked that what the Nation needs is to get off relief and on belief really has something. . . .

■

And if you don't think that the Federal Government's direct care of the individual citizen through relief has had an effect on what the citizen thinks of his Congressman or Senator, just take a look at the letters they get nowadays. . . . It used to be: "Dear Senator—May I respectfully suggest that you give consideration to, etc. . . ." Now they begin: "Dear Senator—You are requested to immediately get busy and . . ."

With the **COAL DIVISION**

of the **AMERICAN MINING CONGRESS**

STANDARDIZING TROLLEY WIRE FOR MINE USE

By A. L. JOHNSTON *

THE ordinary Round Shape hard drawn copper wire was originally used for the majority of coal mine installations in the early stages of development and prior to the year 1900, as this shape was being used exclusively by street railway operations and giving excellent results. However, it was soon apparent that owing to widely different operating conditions, round wire was not suitable for trolley operation for either inside or outside mine service. Trolley wire for street railway service was installed principally on tangent construction. All curve and turnout work was laid out with long radius bends, and as there were no short radius curves encountered, it was possible to utilize 12 or 15-in. bronze ears with thin lips, which did not seriously affect the passage of the trolley wheel, or offer much resistance in the contact circuit.

On the other hand, trolley wire for mine use was often installed on short radius curves and turnouts; the wire was subjected to slate falls, the current demands were greater, more supports were required per mile of wire, more splicers were required (on account of greater number of breaks), inspection was difficult—all of which made it necessary to utilize a mechanical type of trolley clamp with short jaws and sufficient strength to meet such conditions, and which could be installed with minimum time and effort.

* This discussion is presented to the Coal Division of the American Mining Congress by A. L. Johnston who is Chairman of the Technical Committee on Overhead Trolley Line Material of the National Electrical Manufacturers Association which is recommending standard trolley wire shapes and sizes to the A. S. T. M. The Power Committee of the American Mining Congress, of which Mr. Johnston is also a member, has been asked to represent the mining industry on the A. S. T. M. Committee.

Trolley Wire Clamps

The greatest objection to the use of round shaped trolley wire for mine service was the difficulty of obtaining a trolley clamp that would exert sufficient clamping effect on the wire to resist strains encountered in service, without causing an objectionable "hump" on the wire, which interfered with the passage of the trolley wheel.

In order to keep the cost of trolley clamps at a minimum, and to secure requisite strength in the clamping jaws, malleable iron parts were used instead of bronze. While this was a step in the right direction, it also introduced another complication, as the iron jaws added considerable more resistance in the contact system, and each time the trolley wheel passed over a clamp used on round wire a very destructive arc occurred. This action not only rapidly destroyed the iron clamp jaws, but it also had a very detrimental effect on the wheel groove, making constant wheel replacements necessary. Furthermore, it was necessary to obtain the proper type clamp for suspending each particular size of round wire used, as the 4-0 clamp could not be used interchangeably on the 2-0 size of wire.

Fig. 1 shows a cross section of 4-0 round wire supported by a trolley clamp, and clearly indicates lack of any contact between wheel and trolley

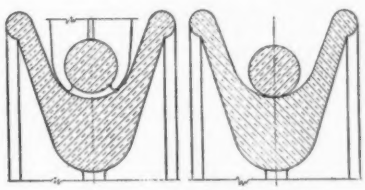


Fig. 1 Fig. 1-A

wire which occurred at each suspension point. Fig 1-A shows normal clearance between wheel and wire.

Figure 8 Trolley Wire

Realizing the difficulties resulting from the attempted use of round wire for trolley contact purposes in mine work, the wire manufacturers introduced a new style shape, commonly referred to as "Figure 8" inasmuch as it resembled somewhat the numeral "8" in cross section, having a small top lobe, a neck, and a larger bottom lobe. It was made in sizes of 1, 2, 3 and 4-0 capacity. This wire was used almost exclusively in mine work until the advent of the grooved trolley wire (referred to later).

The top lobe of Fig. 8 wire provided a section that could be rigidly clamped or held by the trolley clamp, thus leaving the lower lobe entirely clear of any projecting part of the clamp fitting, and providing an unbroken surface for passage of the trolley wheel. See Fig. 2.

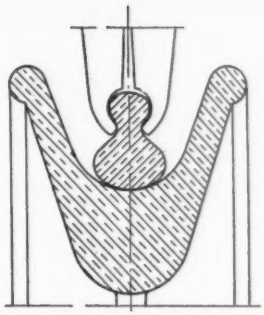


Fig. 2

The conventional mechanical trolley clamps available on the market could all be used interchangeably on the four sizes of Fig. 8 wire, which was impossible in case of clamps for use with round wire. Within the past few years there has been a constantly increasing demand for a Fig. 8 trolley wire having a larger area and increased carrying capacity over the 4-0 size. This has resulted in the development of a so-called 6-0 and a 350,000 c.m. size, which are now available. Theoretically the area of a 6-0 wire would be approximately 336,400 cir. mils but the A.W.G. (B&S) wire tables and gauges make no provision and do not recognize any reference to copper wires larger than 4-0 by number—the area of 4-0 wire being 211,600 c.m. All sizes larger than 4-0 are designated by the circular mil area of the wire instead of numbers. The adopted standards for *grooved* wire for 4-0 and larger sizes are 4-0 (211,600 c.m.) 300,000 c.m. and 350,000 c.m. No doubt the same policy will be followed when the standards covering Fig. 8 wire are adopted.

The present practice of referring to or specifying 6-0 trolley wire regardless of whether Round, Fig. 8 or grooved, should by all means be discouraged as such reference causes endless confusion and is provocative of many arguments and errors, all of which can be entirely eliminated by specifying only the cir. mil area of all trolley wire larger in diameter than the 4-0 size. The difference in carrying capacity between a so-called 6-0 wire (336,400 c.m.) and one having an area of 350,000 c.m. is only 13,600 c.m., which is less than the area of one No. 8 B&S gauge round copper wire.

Larger Wire Thoroughly Justified

The increased use of large diameter trolley wire by the coal mining interests is entirely justified on account of the excessive current loss on the overhead trolley system, especially in cases of older operations where line losses are greater on account of distance involved, and the difficulty of installing adequate feeder circuits.

A comparison of the voltage drop for a given load and distance involved between a regular 4-0 Fig 8 trolley wire and one having an area of 350,000 c.m. is as follows: Assuming a distance of 2,000 ft. and a load of 800 amps., the drop in potential would be 80 volts when using a 4-0 wire. By substituting a 350,000 c.m. wire under the same conditions, the total drop would be only 48 and a fraction volts.

Excessive power costs are obviously reflected in the increased cost per ton of all coal mined; therefore, any means of decreasing the voltage drop by increasing the trolley wire size and providing a supplementary feeder system tied in with the trolley circuit will insure more efficient operation of all electrical equipment, and effect a decided reduction in the annual power bill. The difference in weight per 1,000 ft. between 4-0 trolley wire and the 350,000 c.m. size is only 423 lbs., and assuming a market price of 11 cents per lb. for copper wire, the increased cost per 1,000 ft. of the larger size wire would be only $46.53. This would appear to be an exceptionally economical means of securing the desired results.

The only difficulty encountered at present when using Fig. 8 trolley wire is the lack of uniformity in contour and radii of curvature of the cross section of the various sizes now on the market. At present there is no American Standard covering specifications and dimensions for this shape trolley wire, although such wire represents a large part of the annual purchases by the mining industry. In view of this fact, a number of committees representing the various interests involved are endeavoring to draw up a set of specifications for Fig. 8 wire which will be acceptable to the wire manufacturers, the users and manufacturers of trolley wire fittings.

The lack of similarity in shape between the various sizes from 2-0 to 4-0, also the 350,000 c.m. size (especially the top lobes) is clearly indicated by referring to Fig. No. 3, and while it is possible to design one style of trolley clamp having an operating range that would take care of the sizes from 2-0 to 4-0 inclusive, it obviously would be difficult if not impossible to furnish one style of clamp that could be used to equal advantage over the entire range of Fig. 8 sizes as now furnished.

The large size 350,000 c.m. Fig 8 wire requires a very rugged type clamp that will withstand considerable abuse when installing the wire, especially on curve construction, on account of the heavy lower lobe being unsupported by the clamp jaws and there is a decided tendency for such wire to roll or twist out of the clamp jaws when slack is taken up in the line. To overcome this tendency it is essential that the clamp jaws be designed to conform exactly to the contour of the wire.

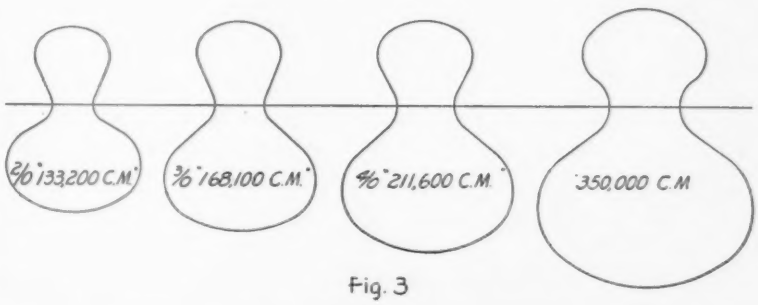


Fig. 3

In consideration of the fact that a number of mining operations use both Fig. 8 and the grooved section trolley wire for their overhead systems, it is apparent that one style of trolley clamp (which could be used interchangeably with either shape) would greatly simplify the matter and reduce customers' stock of reserve trolley clamps accordingly. The suggestion has therefore been made to the proper committee that they seriously consider modifying only the shape of the present round top lobe of the Fig. 8 sections to more of an angular shape resembling somewhat the standard top lobe of the grooved sections. If such change could be made by the manufacturers of wire it would automatically eliminate all need for the special trolley clamps which fit only Fig 8 trolley wire.

In view of the foregoing and in the interests of standardization, simplification and uniformity of wire shapes between the different wire producers, it is hoped that the committee handling this matter will soon be in position to submit to the A. S. T. M. for approval a proposed standard covering all sizes of Fig. 8 trolley wire.

Grooved Trolley Wire

Standardization of the grooved wire has been finally completed and all correspondence and reference to grooved wire should now be made by definitely specifying "American Standard Grooved Trolley Wire Sections." This will insure that the buyer will obtain wire conforming to the high standard now established, which includes method of manufacture, factory tests for torsion, resistivity, tensile strength, dimensions and permissible variation, weight, finish and packing, etc.

The American Society for Testing Materials publish these Standard Specifications under designation A. S. T. M. B47-37, and the American Transit Engineering Association under Manual Section D2-37. They are also approved as an American Standard by the American Standards Association under designation A. S. A. No. H22.2-1937. The great value of such specification lies in the fact that they were prepared under the joint cooperation of the American Transit Engineering Association, the Association of American Railroads, and the American Society for Testing Materials; and full recognition was given the wire manufacturers as well as the manufacturers of trolley fittings. Other interests were represented by the National Electrical Manufacturers Association.

Fig. 4 shows enlarged cross sections of the 4-0 (211,600 c.m.) 300,000 c.m. and 350,000 c.m. sizes of Standard Grooved wire, while the table gives the most important dimensions, weights, etc. All reference to the so-called 6-0 grooved wire is omitted entirely in the Standard Specifications and Tables, for the reason that the B&S wire gauge uses numbers such as 14, 10, 8, 6, 1-0 and 4-0, etc., only where the circular mileage area is 211,600 (4-0 size) or smaller; all sizes larger than 4-0 are referred to by the nominal circular mil area, as in the case of stranded copper cables.

The 300,000 c.m. and the 350,000 c.m. sizes of grooved trolley wire included in Standard Specifications should be entirely adequate to take care of the overhead contact systems in mines without necessity of resorting to the use of non-standard sizes, such as 6-0 capacity. The Fig. 9 wire section (referred to later) is available in the 400,000 c.m. size.

Advantages of Grooved Trolley Wire

Grooved trolley wire is extensively used by the mining industry in preference to Fig. 8 for the following reasons. Being round in cross section there is less tendency for this wire to roll out of the clamp jaws where strains are excessive, such as on curves and turnouts; it can be handled and removed from the reel much easier than Fig. 8 wire; sharp bends or twists resulting from slate falls or accidents are not a serious problem to rectify in case of grooved wire, but it is an extremely difficult matter to replace damaged Fig. 8 wire in the supporting clamps; trolley splicers on grooved wire offer less obstruction to wheels or shoes, but on Fig. 8 wire it is difficult to maintain them in an upright position; grooved wire may be salvaged from old workings and transferred to new locations with far less cost of handling than the Fig. 8 shape.

Some of the objections offered against grooved wire, especially the 4-0 and smaller sizes, is the fact that the jaws of the supporting trolley clamps offer more of an obstruction to the passage of the trolley wheel than those on Fig. 8 wire. This causes arcing and rapid wear of the wheel as well as the clamps. There has been some criticism from users caused by non-standard wire being furnished, and difficulty was experienced from lack of sufficient depth in the groove, or incorrect angularity of the lower face of the top lobe. Also, in some cases the grooves were not located in proper relation to wire center, or there was too great a deviation from accepted dimensions. However, the adoption of the present American Standard includes all necessary provisions to protect the buyer, provided he specifies accordingly.

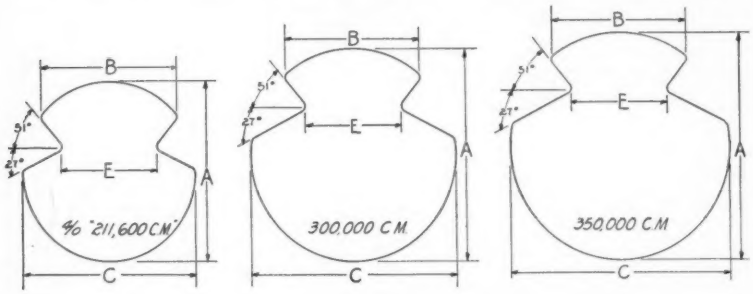


Fig. 4

A. S. T. M. Specifications for Grooved Wire

A.W.G. (B & S)	Area		Dimensions Inches				Minimum Breaking Strength In Lbs.	Volt Loss per Ampere per 1000 Ft. of Trolley Wire	Weight per 1000 Ft.
	Nominal Cir. Mil.	Square Inches	A Section Depth	B Upper Lobe Width	C Lower Lobe Width	E Web Thickness			
	350,000	.2758	.620	.376	.620	.267	11,804	.03014	1063
	300,000	.2355	.574	.376	.574	.267	10,409	.03529	908
4-0	211,600	.1665	.482	.376	.482	.267	7,759	.04992	642
3-0	168,100	.1314	.430	.340	.429	.237	6,373	.06326	506
2-0	133,200	.1083	.392	.318	.388	.217	5,437	.07675	417

Size Limits of Grooved Wire With Fittings

It should also be borne in mind that there is a limit to the maximum diameter of grooved wire that can be used in connection with standard 1½-in. width trolley wheels and conventional trolley fittings, such as splicers, etc. The diameter of the 350,000 c.m. grooved trolley wire is approximately ⅝ in., which corresponds approximately in size to the bottom of the regular trolley wheel groove, thus providing an excellent contact surface. However, when such fittings as splicers, frogs, section insulators, etc., are used on this larger wire, the outside diameter of such fittings must obviously be larger than the wire and the lower part of the wheel groove. Consequently, only the upper or wider part of the wheel groove is capable of passing over such fittings. This naturally reduces the contact area and also interferes with the smooth action of the wheel.

Fig. 5 shows a section of 350,000 c.m. grooved trolley wire and cross section of a standard K. I. type splicer having minimum wall thickness, together with cross section of a standard grooved 1½-in. width wheel. The lack of full contact between the splicer and the groove of the wheel is very apparent.

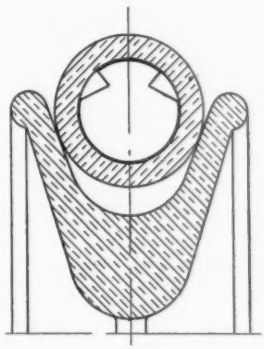


Fig. 5

To increase the present standard width of 1½-in. trolley wheels (in order to secure a wider groove) would mean that special trolley frogs, crossovers, etc., would have to be designed and installed on all overhead systems, as all such trolley fittings are now furnished for use with standard width trolley wheels.

If future developments indicate a demand for grooved wire having a larger area than 350,000 c.m. it may become necessary to develop a modified shape of the present standard grooved section, in which case no doubt the upper lobe, the groove, and the lower lobe width would have dimensions identical with the present 350,000 c.m. size. In order to secure an area of 400,000 c.m. it would be necessary to increase the depth of the lower lobe a sufficient amount, thus giving a section having greater depth than width. If, and when drawn, such a section would permit the use of practically all standard fittings now available for use with the present large size grooved shapes, and the maximum horizontal diameter would not exceed .620 in. plus allowable tolerance. The cross section, however, would depart from the present cylindrical shape of standard grooved wire and somewhat resemble the present Fig. 9 wire.

Figure 9 Deep-Section Grooved Trolley Wire

This particular shape of the hard drawn copper wire has been on the market for a number of years and was originally obtainable from only one manufacturer. At present it may be secured from several companies who draw bare copper trolley wire. It has been referred to in the past as Style No. 9, Fig. 9, Shape 9, 9-0, 9-0 Grooved, etc. The correct designation at this time is Fig. 9 Deep-Section Grooved Trolley Wire, and its area in c.m. is now recognized as 400,00 c.m.

In the proposed A. S. T. M. Standard for this wire the top lobe and groove angularity will conform to the American Standard Specifications, known as A. S. T. M. B47-37 for 4-0 and larger size grooved wire, making it possible to utilize standard clamps as furnished for the regular grooved wire. The lower lobe, however, departs from the American Standard, inasmuch as it is narrower and deeper in proportion in order to secure the required area of 400,000 c.m. This proposed Fig. 9 Standard will be submitted to the American Mining Congress for approval in due time.

Formerly there was considerable lack of uniformity in the contour and area of this wire, as furnished by different wire companies, and which was reflected in the difficulty of obtaining standard fittings to be used in suspending and splicing such wire. Furthermore, the top lobe and groove dimensions did not correspond with the American Standards for grooved wire. In spite of these facts a number of the larger coal operations standardized on this shape owing to the fact it was the only trolley wire available having the required area of 400,000 c.m., and which provided much greater carrying capacity. Very often it was unnecessary, with this large diameter wire, to install additional feeder circuits to maintain voltage within the allowable limits.

The present tendency towards complete mechanization in the more modern operations naturally imposes a much heavier electrical load on the trolley and feeder systems, and to prevent excessive drop in potential and increased current demands for all electrical equipment, it is essential that conductors of ample capacity be installed. The drop in voltage on a 400,000 c.m. Fig. 9 Deep-section grooved trolley wire supplying 800 amps. at a distance of 2,000 ft. is only a fraction over 34 volts, while under the same condition the drop in potential over a 4-0 size trolley wire would be approximately 80 volts.

The narrow cross section of approximately 9/16 in. (in comparison with the ⅝-in. diameter of the smaller area 350,000 c.m. standard grooved wire) and the deep lower lobe of Fig. 9 Deep-Section trolley wire, provide a conductor that has an exceptionally good wheel clearance. The jaws of the trolley clamp offer no obstruction to the groove of the wheel, all of which insures a better contact between wheel and wire and considerably longer life for the trolley wheel and less wear on the trolley clamps.

Fig. 6 shows the exceptionally good contact between wheel groove and splicer on Fig. 9 Deep-section trolley wire.

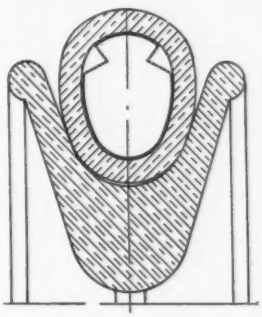


Fig. 6

Many conferences over a period of years have been necessary to coordinate the activities of the various interests in reaching definite conclusions relative to trolley wire specifications in order to meet the approval of all concerned. The adoption of a Standard by A. S. T. M. and A. S. A. represents considerable effort, correspondence, research and experimental work on the part of the different committees and manufacturers before such activity showed any tangible results. Therefore, it should be a matter of considerable interest and importance to the mining industry that such wire standards and recommendations have been adopted. Furthermore, it insures the user receiving a standard and approved product with which it is possible to utilize to the best advantage the standard line of trolley fittings designed to fit the standard wire shapes —both of which can be secured promptly from manufacturers' stock.

New Alabama Producer

The Cane Creek Coal Mining Company, which has been developing its No. 2 Bankhead Mine, at Bankhead, Walker County, Alabama, for some time, has commenced the production of coal in quantity at this operation.

WHEELS of Government

● *As Viewed by A. W. Dickinson of the American Mining Congress*

THE weeks preceding the adjournment of the Seventy-fifth Congress on June 16 witnessed a real desire on the part of legislators to wind up and go home to their congressional districts and states for the activities of the campaign year. The results of the primary elections in Iowa, following the upset in Pennsylvania, brought anxiety, and were most surely a determining factor in ending any thought of reviving the defeated governmental reorganization bill, or of delaying adjournment after the enactment of wage-hour legislation to do battle over the amendments to the Walsh-Healy Government Contracts Act or other controversial measures.

Taxation

On May 27, ten days after the revenue bill of 1938 had been sent to the White House, the bill automatically became law without the approval of the President.

In an address delivered to a high school graduating class at the Federal Resettlement Project town of Arthurdale, W. Va., the President stated that he had refused to sign the bill because he felt that it was a congressional action which "vitiated" administration tax principles. The address contained statements of plans for further revisions of the tax laws in 1939, although as yet there has been no appointment of a Ways and Means Subcommittee to carry on a study this fall in a manner similar to that pursued in the preparation of the revenue bill of 1938. Studies of the tax law are, of course, being carried on by the Treasury Department as well as by the staff of the Joint Committee on Internal Revenue Taxation. L. H. Parker, chief of staff for the Joint Committee since its creation in 1926, has resigned to enter tax practice in Washington, and has been succeeded in this position by C. F. Stam, for many years able counsel to the Committee.

Wage-Hour

The "Fair Labor Standards Act of 1938" was the subject of intensive work in the long sessions of the conferees following its passage by the House on May 24. After the agreement reached in the Senate on May 26 between the southern Senators and the sponsors of the bill, which was followed by the appointment of Senators Ellender of Louisiana and Pepper of Florida as conferees, it was openly stated that the conferees intended to rewrite the wage-hour legislation within the limits of the two bills approved by the Senate and House. This was done, and on Sunday, June 12, the conferees reported a measure which on June 14 was approved by both Houses.

The law carries a 25 cents per hour minimum wage for the first year and a 30-cent minimum wage for the second year. Thereafter within seven years from the effective date of the Act the minimum wage increases to 40 cents per hour unless such a wage is found by the Administrator, in the Department of Labor, and his industrial boards to involve unemployment in an industry. The industrial boards are to be appointed by the Administrator with a representation of one-third each of management, labor, and consumers.

Of particular interest to the mining industries are the hours provisions and the sections of the law covering the averaging of the working hours over 26-week and 52-week periods which are herewith reproduced:

"MAXIMUM HOURS

"Sec. 7. (a) No employer shall, except as otherwise provided in this section, employ any of his employes who is engaged in commerce or in the production of goods for commerce—

(1) for a work week longer than 44 hours during the first year from the effective date of this section,

(2) for a work week longer than 42 hours during the second year from such date, or

(3) for a work week longer than 40 hours after the expiration of the second year from such date,

unless such employe receives compensation for his employment in excess of the hours above specified at a rate not less than one and one-half times the regular rate at which he is employed.

"(b) No employer shall be deemed to have violated subsection (a) by employing any employe for a work week in excess of that specified in such subsection without paying the compensation for overtime employment prescribed therein if such employe is so employed—

(1) in pursuance of an agreement, made as a result of collective bargaining by representatives of employes certified as bona fide by the National Labor Relations Board, which provides that no employe shall be employed more than 1,000 hours during any period of 26 consecutive weeks,

(2) on an annual basis in pursuance of an agreement with his employer, made as a result of collective bargaining by representatives of employes certified as bona fide by the National Labor Relations Board, which provides that the employe shall not be employed more than 2,000 hours during any period of 52 consecutive weeks, or

(3) for a period or periods of not more than 14 work weeks in the aggregate in any calendar year in an industry found by the Administrator to be of a seasonal nature.

And if such employe receives compensation for employment in excess

of 12 hours in any work day, or for employment in excess of 56 hours in any work week, as the case may be, at a rate not less than one and one-half times the regular rate at which he is employed."

While it is unlikely that the Administrator will be named until after the Act is approved by the President, it is known that within the Department of Labor planning has been under way for some time outlining a form of organization for administering the law, and it is anticipated that this will move quickly as soon as the Act becomes effective.

In connection with the wage-hour law, it is of interest to note that the President has authorized a study of British labor laws which may have a direct bearing on the movement in both Houses of Congress for amendment of the National Labor Relations Act in the next session. While there have been rumors that the National Labor Relations Board may, under the present Act, give recognition to requests of employers for determination of the "proper collective bargaining units," the representatives of the Board at the present time officially deny that there is any intention of undertaking such procedure.

Government Contracts

In the last days of the session the proposed Wagner amendments to the Walsh-Healy Government Contracts Act, which would require all contractors doing $2,000 or more business with the Government to agree to abide by National Labor Relations Board rulings and would further provide for "blacklisting" all contractors failing to comply with such rulings, was stopped by the Committee on Rules of the House. This was in the face of strong pressure from representatives of labor which aroused decided resentment among members of the House Judiciary and Rules Committees. As the bill had passed the Senate, it contained a further provision which made subcontractors in the amount of $500 or more subject to the same conditions as the principal contractor.

Monopoly

Outcome of the President's message calling for the investigation of alleged monopolistic practices and price fixing was passage of the O'Mahoney resolution late in the session and appropriation of $500,000 for the study. Under the resolution there is created a "Temporary National Economic Committee" on which have been appointed Senators O'Mahoney, Wyoming; King, Utah; and Borah, Idaho. House members appointed are Representatives Sumners, Texas; Eicher, Iowa; and Reece, Tennessee. Under the resolution, the Departments of Justice, Treasury, Labor, and Commerce, as well as the Federal Trade Commission and the Securities and Exchange Commission, are to have representatives on the Committee. It is too early to predict the course of study which the Committee will pursue, but it is well known that the materials entering into Government construction projects, notably cement and steel, have been commented upon by Interior Department Secretary Ickes and others in the executive departments for many months.

Stream Pollution

The sturdy position maintained since August, 1937, by the House conferees, headed by Judge Mansfield of Texas, in defense of the original form of the Vinson bill (H. R. 2711) as it had passed the House, was justified in early June by the final agreement reached by the House and Senate conferees. In their report and in the form of the bill approved by both Houses, the amendments of the Senate, which would have made a punitive water pollution law harmful to the mining industries, were eliminated. The law now provides a planning and survey approach to the real problems of water pollution with grants and loans to state and municipal bodies as well as to individuals. The enactment of the law in this form provides for proper cooperation with efforts made by interested industries for a number of years to solve pollution problems in the public interest.

Natural Gas Act

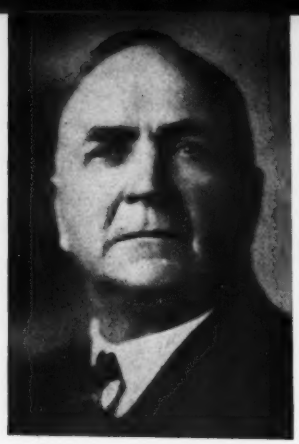
Passed by the House and pending in the Senate since the first session of the Seventy-fifth Congress, the law providing for control of the natural gas industry by the Federal Power Commission was enacted in the closing days of the Congress. An amendment from the floor of the Senate would have removed the authority of the Federal Power Commission to grant increases in the price of gas to the pipe line companies, but in the House this amendment was modified (with Senate concurrence) so that rate increases may be granted upon the filing of new tariff schedules. The Act is important to producers of anthracite and bituminous coal who are in competition with natural gas and who have lost a material part of their markets in recent years due to the low price policies pursued by the pipe line companies in some sections of the country.

(*Concluded on page 58*)

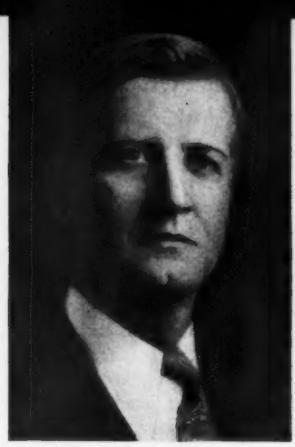
—*Horydczak.*

Looking from Main Door of the White House to Jackson Square

Leo J. Hoban



J. G. Clark



W. T. Lundy

Harry Y. Walker

James W. Wade

State Chairmen

Shaping Plans For Metal Mining Convention

THE past month has witnessed important strides in shaping plans and arrangements for the fifth annual Metal Mining Convention and Exposition of the Western Division, American Mining Congress, to be held in the Ambassador Hotel at Los Angeles, October 24 to 27.

As evidence of the significance attached to this annual meeting by the industry, 120 leading mining executives and operators have accepted appointment on the National Program Committee, under the chairmanship of T. H. O'Brien, vice president and general manager, Inspiration Consolidated Copper Company, and 16 state and district chairmen (see cuts—pictures of C. E. Dawson, Bald Mountain Mining Company, and Ott F. Heizer, Nevada-Massachusetts Company, Inc., chairmen of the South Dakota and Nevada state committees, respectively, not available). Suggestions for pertinent and timely subjects to be discussed on the program have been pouring into headquarters, supplying valuable material from which to choose the topics which are today of most vital concern to the industry.

At a meeting called by Mr. O'Brien at the Ambassador Hotel, Los Angeles, on June 21 to which these suggestions were submitted, plans for the convention in October were thoroughly discussed and general outlines of the program were formulated. Prominent among the subjects to be discussed by leaders in their respective fields will be—industrial relations today and the operation and effects of the National Labor Relations Act; relation of Government to industry; Government finance and present-day taxation, with special reference to the mining industry; future prospects for the metals—gold, lead, zinc, copper, silver, and other metals and major nonmetallic minerals; the financing of mining properties, including a report of the American Mining Congress Committee on

Brent N. Rickard

C. E. Abbott

J. J. Carrigan

Thomas McCormack

Robt. W. Thomas

Ira L. Wright

M. D. Harbaugh

Roger O. Oscarson

G. W. Johnson

State Chairmen

Cooperation with the Securities and Exchange Commission, and a full discussion of the problems of registering mining securities and securing capital for new developments; tariff protection for minerals, and the effect of reciprocal trade treaties on mining enterprise; the "right to mine" and its protection against encroachment by interests unfriendly or unsympathetic with the needs of mining; application of wage-hour legislation to mining operations; dust elimination, and improvement of safety and health conditions in mining; strategic minerals of the west; and public relations of the minerals industries. Important developments in mine and mill operations, of general interest and applicability, will also be featured on the program.

Once again there will be a stupendous exposition (with apologies to Hollywood) of the newest developments in mining equipment and supplies, presented in the beautiful Fiesta room of the Ambassador, that will merit and command thorough inspection by the hundreds of delegates who will there seek the answer to perplexing production problems now facing the industry under reduced metal prices.

Topping it all will be a program of entertainment carrying out the traditional warm hospitality and informality of the West. All in all, it will be a week of valued education and fun that you can't afford to miss!

Meeting of National Program Committee at Los Angeles, June 21. Standing (left to right): A. B. Campbell, Brent N. Rickard, Albert F. Knorp, and Robert W. Thomas. Seated: Charles F. Willis, Victor J. Hayek, W. C. Browning, Thomas H. O'Brien, Chairman, Senator Thomas McCormack, Julian D. Conover, and Howard Kegley. Robert Linton (not shown) also attended

NEWS and VIEWS

Colorado and New Mexico Association Elects Officers

At the recent annual meeting of the Colorado and New Mexico Coal Operators Association, held in the offices of the organization at Denver, the following members were elected to serve as directors for the ensuing year: N. C. Anderson, L. H. Connell, Gilbert C. Davis, George B. Dick, C. R. Garrett, D. L. Hansen, Homer H. Harris, Moroni Heiner, John Kirkpatrick, Douglas Millard, E. C. Oliver, Floyd Pool, S. M. Thompson, L. C. White, and F. R. Wood.

Officers elected for the year beginning May 1, 1938, included: L. C. White, president; Homer H. Harris, vice president; and F. O. Sandstrom, secretary, treasurer and traffic manager.

Contract Awarded for Coalburg Tipple

The Kanawha Manufacturing Company, Charleston, W. Va., has obtained a contract from the Riverview Mining Company, Coalburg, to replace the coal tipple which was destroyed by fire on March 1.

Replacement of the plant will involve an expenditure of $100,000, and it is planned to have it in operation by August 1. With a capacity of 2,000 tons per day, the tipple will be capable of loading coal on Chesapeake and Ohio lines, or in barges for river shipment, and will be of the latest modern design.

Phosphate Study Asked By President

Declaring that it is high time for the nation to adopt a national policy for the production and conservation of phosphate, and recommending that a joint committee be named to study the subject of phosphate resources and make a report to the next Congress, President Roosevelt sent a special message to Congress on May 20.

The President told Congress he could not overemphasize the importance of phosphorous, not only to agriculture and soil conservation but also to the physical health and economic security of the nation. He called attention to the fact that the phosphorous content of the land of this country, after generations of cultivation, has greatly diminished and needs replenishing. A wider use of phosphates in the interest of soil conservation was strongly urged.

After citing figures on domestic and world production of phosphates, and pointing out that considerable amount of the domestic production now coming mainly from southeastern States is exported, the President stated: "It is hardly necessary to emphasize the desirability of conserving these deposits to the fullest extent for the benefit of agriculture in the East, the South, and a considerable portion of the Middle West. At the same time, serious attention should be given to the development of the western phosphate deposits in order that they may be made to serve economically the widest possible territory. It is evident that our main reliance for an adequate supply of phosphates must eventually be placed on our western deposits. . . .

"The disposition of our phosphate deposits should be regarded as a national concern. The situation appears to offer an opportunity for this nation to exercise foresight in the use of a great national resource heretofore almost unknown in our plans for the development of the nation. . . .

"To the end that continuous and adequate supplies be insured, and that sufficient forms of this key element, phosphorous, be available at the lowest cost throughout the country, I recommend that the joint committee of the Senate and House of Representatives be named to give study to the entire subject of phosphate resources, their use and service to American agriculture, and to make reports to the next Congress."

Both Houses of Congress approved before adjournment a resolution authorizing a study into the Nation's phosphate resource, providing $10,000 to carry out the survey.

Members of the committee, representing the two houses, who will carry out the investigation, are Senators Pope (Idaho, chairman), Pepper (Fla.), Norris (Nebr.), and Representatives Leavey (Wash.), Peterson (Fla.), and Case (S. Dak.).

The committee has already held one meeting and is planning an extensive summer and fall survey of phosphate deposits and their utilization, amount of foreign sales, extent of monopoly, etc. Much attention is expected to be given the huge phosphate fields in Idaho with the idea of making use of excess Federal power from hydro-electric developments to produce cheap phosphate for fertilizer.

West Virginia Institute Meeting

The annual meeting of the West Virginia Coal Mining Institute will be held at the Kanawha Hotel in Charleston, W. Va., on Friday, October 7.

Redtop Developments

Two of the main ore shoots encountered in the 2,000-ft. tunnel on the property of Redtop Mining Company, in northern Stevens County, Wash., are being developed. The first is 4 ft. wide, in which a raise is being extended, the assays averaging 13 percent zinc, 16 percent lead, and 7.6 oz. in silver. At the same time a shaft is being sunk in this ore below the tunnel. In raising, the ore ceased abruptly at 60 ft., and in going down it ceased in the same way at 30 ft. This unexpected occurrence was explained by

drilling to offsets where the ore was encountered 4 ft. to the east in the raise, and 5 ft. to the west in the winze. The raise and winze are following the 70-degree dip of the ore. The raise is being continued and bent to the east to encounter the ore again. The second ore shoot is said to be 50 ft. wide, with assays across 6 ft. of it showing 2.6 percent zinc, 20.4 percent lead, and 8.2 oz. in silver.

This company's property was opened by the late August F. Heinze 35 years ago. The present company is financed in Minneapolis. S. I. Serigstag, of that city, is president, and J. Richard Brown, Spokane mining engineer, is in charge.

Scott's Run Cleaning Plant

Announcement was recently made by Joseph Pursglove, Jr., assistant general manager of the Pursglove mining operations, that a $100,000 coal cleaning plant would be erected at the No. 5 mine of the Pursglove Gas Coal Corporation on Scott's Run, W. Va. The new plant will have a capacity of 4,000 tons per day.

Morning Mine Closes

The Morning mine of the Federal Mining and Smelting Company, at Mullan, Idaho, in the Coeur d'Alene District, which employs more than 600 men, closed down on June 25, according to an announcement by General Manager H. G. Washburn. Low metal prices and uncertain business conditions caused the cessation of operations at the property, one of the leading producers in the district. The closing order will not affect the operations at the Page mine in the Kellogg District, owned by the same company.

In a formal statement covering the closing order, Manager Washburn stated:

"The present known ore reserves of the Morning are limited to a few years of operation at capacity and if extracted at the present prices of lead and zinc would return little or no profit.

"Therefore, the Federal Mining and Smelting Company has decided to close the Morning mine on June 25, 1938, continuing through the month of July and possibly longer, depending on whether the prices of lead and zinc rise substantially above present levels. In order to offer work to its employes, the company, so far as its financial condition will permit, plans to run the mine during the winter season, even if metal prices do not improve and it has to store part or all of the lead and zinc produced.

"During the shutdown, exploration of the possibility of finding additional ore bodies will be carried on, as well as sinking below the 4,050 level of the present known ore body."

Lovell H. Parker, left, chief of staff of the Joint Committee on Internal Revenue Taxation since its organization in 1926, has resigned from this important post to enter practice with the firm of Guy and Brookes, Edmonds Building, Washington, D. C. Colin F. Stam, right, counsel to the Joint Committee, succeeds Mr. Parker, and both of these able gentlemen have the sincere good wishes of the mining industry in their new work.

Serious Harlan Fire Loss

A fire at the Black Mountain Coal Corporation at Kenvir, Ky., about 12 miles east of Harlan, caused damage estimated at about $1,000,000 on May 17. The tipple house was destroyed and flames spread rapidly up the 550 foot mine conveyor. The head house and supply house were also damaged.

Fifty miners came to the surface to help fight the fire, but no injuries were reported. E. J. Asbury is mine superintendent at the operation.

Mine Inspectors Meet

The 29th annual convention of the Mine Inspectors' Institute of America was held at the St. Nicholas Hotel in Springfield, Ill., June 6, 7, and 8, with a very fine turnout.

The opening session on Monday morning included an address of welcome by the Honorable Henry Horner, Governor of Illinois; by the Honorable John W. Kapp, Mayor of Springfield; and a reply to these by Richard Maize, president of the Institute. A paper on "Safety Practices in Illinois Coal Fields" was read by Leonard Forester, state mine inspector, Percy, Ill.

The Monday afternoon session included a paper by N. P. Rhinehart, chief, Department of Mines, Charleston, W. Va., who spoke on "The Use of Electricity Underground—Installation and Maintenance," with discussion led by John F. Conrad, inspector of electrical equipment, Bituminous Division, Department of Mines, Ebensburg, Pa. An address on "Ignition of Explosive Gases by Electricity and Precautions Necessary to Prevent Them" was presented by P. F. Nairn, deputy secretary, bituminous Division, Department of Mines, Pittsburgh, Pa., with discussion of the

paper by C. A. Herbert, supervising engineer, U. S. Bureau of Mines, Vincennes, Ind. A paper on "Safety Practices in the Wyoming Mines of the Union Pacific Coal Company" was given by Eugene McAuliffe, president, Union Pacific Coal Company, Omaha, Nebr.

Tuesday was known as "play-day," during which guests made a special automobile trip to Fulton County to see two of the largest strip mine operations in the country. Luncheon was served at Buckheart, following which Mr. Thomas Moses, vice president, U. S. Steel Corporation of Delaware, gave an address on "Prominent Mining Men in Illinois."

The Wednesday morning session was a symposium devoted to the problem, "How Can the Mining Supervisory Force Best Be Kept Informed on Up-to-Date Safety Procedure?" the subject being presented by Dan Harrington, chief, Health and Safety Branch, U. S. Bureau of Mines. Discussions were presented by A. D. Sisk, safety director, Big Sandy-Elkhorn Coal Operators Association; H. G. Houtz, special inspector, Department of Mines of West Virginia; S. A. Binek, state mine inspector of North Dakota; Dan J. O'Donnell, state mine inspector of Kansas; and E. A. Farnsworth, state mine inspector of Iowa.

The closing session on Wednesday afternoon was given over to presentation of a paper on "Mine Water in Abandoned Mines and the Menace It Offers to Men Working in Adjacent Mines," presented by John E. Jones, safety engineer, Old Ben Coal Corporation; with discussion by S. J. Phillips, anthracite state mine inspector, Department of Mines of Pennsylvania. Another interesting paper on "Sudden Outbursts of Explosive Gases in Coal Mines and Planned Ventilation to Control Them" was read by George J. Steinheiser, bituminous state mine inspector, Department of Mines of Pennsylvania.

Mr. J. T. Ryan, vice president, Mine Safety Appliances Company, was chairman of the Program Committee, and James McSherry, director, Department of Mines and Minerals of Illinois, was local chairman of the Committee on Arrangements and Entertainment.

Coal Dredging is Cut Sharply

Once a thriving industry, coal dredging in the Susquehanna River near Bloomsburg, Pa., is falling into the classification of a forgotten business, according to a recent survey.

COMMISSION HOLDS DENVER COST DETERMINATION HEARING

The offices of the National Bituminous Coal Commission were temporarily moved to Denver, Colo., the early part of June when the Commission as a body conducted a hearing to determine the cost of production of bituminous coal in the western states. This is the first time the Commission as a body has held a hearing outside of Washington.

This cost determination hearing, which opened in the Shirley-Savoy Hotel, Denver, on June 13, was brought to a close June 16, after the Coal Commission had received the underlying data on necessary price adjustments presented by representatives of the Western District Boards. District Boards 16, 23, 22, 20, 19, 18, and 17, comprising minimum price areas 6, 7, 9 and 10, were represented and submitted testimony.

Representing the Statistical Division of the Commission, F. G. Tryon, Tom W. Hunter and W. B. Reed testified as to the manner in which statistical compilations were established insofar as production costs for each district for the calendar year 1936 were concerned.

R. B. Griffith, auditor, and A. L. Vogl, counsel for District Board 16, submitted evidence supporting suggested cost adjustments based on a 12-month year from April, 1937, to April, 1938, and the manner in which judgment was exercised in dealing with these adjustments. Mr. Vogl, during the testimony of Mr. Hunter, introduced an objection to the submission of any cost data that might be identified with individual producers and was assured by Chairman Tetlow that the Commission did not intend to have such cost data introduced at the hearing.

D. R. Swem, N. D. Moore, William Strain and Stanbery Foster, appearing for District Board 23, strongly protested the inclusion of captive and commercial costs in the computation of the weighted average cost for that district. It was stated that because the cost of captive tonnage is so low it materially would affect the weighted average upon which minimum prices would be based and under which commercial coal would have to be sold.

District Board 22 joined in the protest of Board 23, and T. C. Russell, superintendent of mines, Anaconda Copper Company, and board member for the district, testified that 72 percent of the entire 1937 tonnage for that district was produced from captive mines. D. F. Buckingham presented the revised cost report of the district and G. J. Jeffries appeared as Board counsel. District Board 20, represented by Claire M. Senior, attorney for the Board, and B. P. Manley, submitted its revised cost figures for 1937 which differed slightly from the Statistical Division's compilations, being about 3 cents higher because of increased compensation rates and other factors peculiar to the state of Utah.

A. R. Litts, secretary and treasurer of District Board 18, introduced evidence which showed that the 1936 cost determination figure plus necessary adjustments arrived at by the Board reached a cost differing very little from the figure presented by the Commission's Statistical Division.

On Thursday morning L. W. Mitchell, secretary, District Board 19, testified that the closing of the Owl Creek Mining Co. had necessitated a revision of previously submitted cost data because of a substantial decrease in the total tonnage for that district, and T. J. O'Brien, president, Kemmerer Coal Company and chairman of the District Board, testified as to the manner in which this revised compilation had been reached.

District Board 17, through the Board's attorney, Fred Farrar, reserved the right to enter a memorandum protesting the inclusion of cost data for

WHAT DOES THE CATCHER SAY?

—Wilkes-Barre Times Leader.

the first three months of 1938 as presented in District Board 16's cost determination, in the event that it is found to be prejudicial to that district. W. J. Thompson, president, Colorado and Utah Fuel Co., upon direct questioning testified that he felt costs should be higher than in Districts 16, 18 and 20 because of higher sales costs.

The Commission adjourned the hearing after re-examination of Statistical Division witnesses by representatives of the consumers' counsel with regard to certain district adjustments and to comparative production totals for 1936 and 1937.

Representatives of the Association of American Railroads, municipalities and other consuming interests were present at the hearing, and many of them took advantage of the opportunity which the Commission afforded of cross-examining witnesses.

On June 15, the United States Circuit Court of Appeals for the District of Columbia, heard oral arguments on a petition of the Mallory Coal Company and seven associated producers to have the court issue a stay order preventing the Commission from making available to interested parties underlying cost data. The Commission previously had issued a ruling saying that the information would be made available at the final cost hearing. Robert E. Quirk, a Washington attorney, represented the producers. Commission argument was presented by Robert L. Stearn, Department of Justice, and Thomas O'Brien, of the Commission's legal staff.

At the close of the argument Mr. Chief Justice Groner said that the court would reach a decision in the next two or three weeks.

Carson Urges Costs Publication

John Carson, consumers' counsel, filed a brief in the same court arguing for publication of costs of production of individual coal mines, and supported the National Bituminous Coal Commission's ruling that individual cost reports could be used as evidence in hearings. The brief, which cited many court decisions to support its legal conclusions, emphasized that "sound public policy" was involved in the court's action.

"This new experiment in industrial governmental relations," it said, referring to the Coal Act, "is of vital public importance and only a full and fair disclosure of all facts, including individual cost data, will assure adequate public protection and confidence.

"It should be emphasized that this experiment in government-industry relationship is of extreme economic importance. Undoubtedly it will have a direct and important bearing on future attempts to secure a proper balance between the Government and other industries.

"Public policy, therefore, demands a full and fair disclosure. Even the untenable assumption, therefore, that the language of the statute dealing with cost and realization returns of individual producers is ambiguous, the court should resolve any doubts in favor of such disclosure."

Arguments were made before the Circuit Court on June 8 by Robert L. Stearn and Robert L. Knox supporting the Commission's motion to dismiss the petition of the city of Atlanta asking the court to declare prices during the 72-day period they were in effect, invalid. The case was taken under advisement by the court.

The Commission has scheduled a hearing for July 6 in Washington for determination of the weighted average cost of the tonnage produced in the minimum price area number 1, and to continue the hearing on reasonable maximum discounts for price allowances that may be made by code members to distributors.

The final deficiency bill passed by the Congress slashed the $500,000 proposed additional appropriation to be granted the Commission for investigation of failures on the part of producers to pay penalty taxes to $250,000. The Commission had proposed to send into the field 40 of its own agents and 40 from the Internal Revenue to check up on payments to be made under the penalty tax provisions of the act, and to acquaint producers with the Act's provisions and operation.

Phelps Dodge to Continue Operations

Notwithstanding recent announcements of complete cessation of many of the large mines in the western states, Arizona copper properties of the Phelps-Dodge Corporation will continue in operation, according to a recent announcement by H. M. Lavender, general manager.

"Other than the seasonal layoff at Ajo, there are no plans at present for suspension of operations at any of the Arizona operating properties of the Phelps-Dodge Corporation," Lavender said.

It was pointed out that rather drastic adjustments had been necessitated in certain units, and that further adjustments may be required; but the fact was emphasized that there are no present plans for complete suspension of operations. Copper mines operated by the corporation are located at Bisbee, Ajo and Jerome, with smelters at Douglas and Clarkdale. The company is also pursuing an active development program at the Morenci open pit mine.

Capacity of this stripping shovel was increased from 18 to 30 cubic yards by using welded high-tensile steel. The 70-ft. dipper handle is supported by 108-ft. boom. Maximum dumping radius is 114 ft.; maximum dumping height, 77 ft.

Copper Companies Close Mines

In the effort to stabilize the copper market and bring copper stocks in line with reduced demand, several of the country's largest copper producers have recently announced cessation of operations at their mines for an indefinite period.

Of outstanding interest was the posting of a notice by Kennecott Copper Company on June 1 at all of its domestic units that it would suspend operations shortly after the middle of June (the date varies at different mines), and that the shutdown will continue for at least a month. It was stated that the suspension of work may be prolonged beyond that date, although the company expressed the hope that the complete cessation of operation would "not be long continued." Affected by the order are the Utah Copper Mines at Bingham Canyon, Utah; the Garfield Smelter at Garfield, Utah; the Nevada Consolidated properties near Ely, Nev.; and the properties at Ray, Ariz., and Santa Rita, N. Mex. The company's property in Alaska will likewise be closed. All of these operations have been curtailed during recent months to about 40 percent of their capacity in the effort to avoid a complete shutdown. Under this curtailment, the output of the mines had amounted to about 12,000 tons of copper per month.

Text of the Kennecott notice posted at all its subsidiaries stated that:

"Due to the large stocks of copper accumulated over the past eight months as the result of constantly shrinking business and with production still greatly in excess of the tonnage which it has been possible to sell, it has now become imperative, notwithstanding the drastic curtailment of output already in effect, to reduce production to a degree more nearly in keeping with current market requirements. It is, therefore, unavoidable that production of copper be discontinued entirely for a more extended period or periods than heretofore, the duration of which cannot now be determined.

"As a first step in this direction, productive operations at this property will be discontinued on June (date varies) for a period of not less than one month and possibly for a longer time though it is hoped that such complete cessation of operations will not be long continued.

"Employes will be given notice as far in advance as practicable of the date of resumption which as indicated, will depend on the trend of metal market demand."

The only previous complete shutdown of the extensive domestic properties of the Kennecott Copper Company occurred in 1922. At the depth of the depression in 1932 the company operated at about 16 percent capacity.

Similar action was taken a short time previously by the Anaconda Copper Mining Company which has closed most of its Butte mines, and ceased operations at the Walker Mining Company in California, and the Mountain City Consolidated Copper Company in Nevada, both of which are subsidiaries of Anaconda. National Tunnel and Mines Company, operating near Bingham, Utah, another subsidiary of Anaconda, has also closed down indefinitely. Suspension of work at the Mountain City Copper and the Walker mines resulted in the shutdown of the copper department at the International Smelting and Refining Company's smelting plant at Tooele, Utah.

Kanawha Valley Institute's Banquet

More than 400 members of the Kanawha Valley Coal Mining Institute attended the spring banquet of the organization held at the high-school building in Montgomery, W. Va., May 14. William G. Thompson, Montgomery attorney, presided as toastmaster.

"I LIKE TO WATCH YOU WORK"

—Wilkes-Barre Times Leader.

Carel Robinson, president of the Institute, advised members never to sacrifice safety for expense; while Ralph Hartman, secretary of the State Workmen's Compensation Commission, praised the "splendid record" of the coal-producing district which the Institute embraces, from the standpoint of safety, and consequently its lower compensation premium. Other speakers included N. P. Rhinehart, chief of the State Department of Mines, who lauded the Institute as one of the most outstanding in the State; and Al Quinn, who appeared as a representative of Governor Holt. Mayor Arnold M. Vickers was an honor guest.

Cannelton Mine to Resume Work

Operations of mine No. 3 of the Cannelton Coal and Coke Company at Cannelton, W. Va., were resumed May 23, following a shutdown since last November. F. O. Harris, vice president and general manager of the coal company, said that the mine will employ about 140 men.

Wheels of Government

(*Continued from page* 51)

Phosphate Study

The phosphate resources of Idaho, Wyoming, and Montana, as well as of the southeastern states, were made the subject of study and survey in a resolution which provided for a Senate and House Investigating Committee. Quickly following the passage of the resolution was appointment to the Committee of Senators Pope, Idaho; Pepper, Florida; and Norris, Nebraska; as well as Representatives Levy, Washington; Peterson, Florida; and Case, South Dakota. They immediately held a meeting and planned an investigation of the extent of domestic deposits of phosphate, its utilization, amount of foreign sales, and the possibility of using excess Federal power from hydroelectric developments to produce cheap phosphate for fertilizer. It is reported that investigations in the Tennessee Valley have developed new methods of extraction, and it has also been known for several years that the Department of Agriculture has done considerable work in trials of a blast furnace-fume method of extracting phosphate.

PERSONALS

DONALD A. CALLAHAN, attorney and widely known mine operator of Wallace, Idaho, recently announced that he will seek the nomination for United States Senator from Idaho in the fall elections.

In an appeal to the people of Idaho to reassert their independence of thought and action, and pointing out a course which he deemed essential for the future welfare of the nation, Mr. Callahan declared: "I am opposed to the present tendency toward centralization of government in Washington. The disposition of Congress to surrender its authority to the executive and to place in the hands of bureaucratic organizations power to govern by rules and regulations, made effective by executive decree, threatens the continuance of free institutions.

"Independent courts are necessary. From the humblest tribunal to the Supreme Court of the United States, our courts must be maintained free from political domination or interference by either the executive or legislative branches of government."

With reference to the subject of taxes and spending, he stated, "Overshadowing all of these [other pressing public issues] is the great threat of continued deficit and impending confiscatory taxation. Is it not time to think of the terrible implications of the reckless fiscal policies of our present Government? If I forfeit every vote in Idaho, I shall protest the political use of public funds for special projects and the destruction of public morale by prodigal wasting of money."

C. R. BOURLAND, superintendent of the Helen mine of the Koppers Coal Company at Helen, W. Va., has been transferred to the superintendency of the New Kopperston mine of the same company at Kopperston (Wyoming County), W. Va. The work of dwelling construction, tipple and mine installation is well under way with a view to producing approximately 1,000 tons of coal daily from the Eagle seam in November of this year.

H. L. ALTSHULER, resident manager of the Bunker Hill and Sullivan Company, at Kellogg, Idaho, announced his resignation from that office May 23, stating that he would leave soon for San Francisco to make his home.

BENJAMIN F. FAIRLESS, president of the United States Steel Corporation, on a recent tour of the company's large coal holdings, received the rank of a Kentucky Colonel at a banquet at the Gary Country Club, Gary, W. Va.

Presentation was made by Harry Moses, president of the United States Coal and Coke Company, a subsidiary, who himself is a colonel on Governor Chandler's staff. Vice President Thomas Moses, of United States Steel Corporation of Delaware; Frank Walton, president of the United Supply Company, and Arthur Dayton, counsel for the corporation, together with Harry Moses, accompanied Mr. Fairless on the inspection trip.

MACK C. LAKE, consulting geologist and mining engineer, announces the removal of his office to 400 Call Building, 74 New Montgomery Street, San Francisco, Calif.

HARLOWE HARDINGE, vice president and general manager, Hardinge Company, Inc., has returned to the company's general offices at York, Pa., after making a long swing through Canadian territory. The trip took him through the Sudbury, Kirkland Lake, Noranda and Malartic districts, and consumed more than two months. The trip enabled him to make a close study of existing mining conditions as well as each new development in mill control, and Mr. Hardinge returned greatly encouraged over the prevailing situation and the net business results of his trip.

JAMES A. CASELTON, vice president of the National Lead Company, was recently nominated for the St. Louis award for 1937-38. Caselton was nominated because of his campaign

against ambulance-chasing attorneys who pressed damage suits "that were an offense to civic decency." This award is given annually to the St. Louisian who has contributed the most to the betterment of the greater St. Louis area.

B. W. SNODGRASS, president, Moffat Coal Company, Denver, Colo., recently announced that he will be a candidate for governor of the state of Colorado in the next Republican primary.

HORACE MOSES, general manager of the Gallup-American Coal Company, has been appointed general manager of the Chino Mines Division of the Nevada Consolidated Copper Corporation at Hurley, N. Mex. Mr. Moses succeeds the late Rone B. Tempest, and assumed his new duties June 1.

D. L. BROWN, formerly in charge of the Grant Town operations of the Koppers Coal Company, has been transferred to Helen, W. Va.

RUFUS E. ZIMMERMAN, vice president of research and technology, United States Steel Corporation, received the degree of Doctor of Science from Franklin and Marshall College at its commencement exercises in Lancaster, Pa., June 1.

WILLIAM R. CHEDSEY, director of the Missouri School of Mines and Metallurgy, was granted the honorary degree of Doctor of Engineering at the commencement of the Colorado School of Mines, at Golden, Colo., on May 27, for distinguished service in engineering education.

ROBERT GREGG, president of the Tennessee Coal, Iron and Railroad Company, and an alumnus of the Georgia School of Technology at Atlanta, was recently awarded the annual medal given to alumni of the institution yearly in recognition of distinguished achievement.

FLETCHER ROCKWELL, president of the National Lead Company, was recently elected chairman of the Patino Mines and Enterprises Consolidated, Inc., at the annual meeting of this company. In this capacity he succeeds the late Edward J. Cornish. DR. G. W. THOMPSON, of National Lead, was elected a director of Patino Mines in place of W. C. BESCHORMAN, resigned.

George A. Easley, vice-president of the International Mining Co., receiving his diploma as Doctor of Engineering from Dr. F. A. Middlebush, president of the University of Missouri. At left is Dr. Wm. R. Chedsey, director of the Missouri School of Mines and Metallurgy, which school conferred the degree at its commencement on May 24

E. J. WEIMER, assistant division superintendent at Grant Town, W. Va., is now division superintendent of the Federal One and Federal Three operations of the Koppers Coal Company.

—*Obituaries*—

CHARLES E. SCHWARZ, consulting mining and metallurgical engineer of the St. Louis Smelting and Refining Company and the National Lead Company and subsidiaries, died June 1 in St. Louis as a result of a cerebral hemorrhage. He was 64 years of age.

Following his mining studies at the University of Illinois and Washington University in St. Louis, Mr. Schwarz started working for the Central Lead Company at Flat River, Mo., soon after which he joined the engineering staff of the St. Louis Smelting and Refining Company. He later held responsible positions with the National Lead Company, and for a number of years was engaged in private consulting work in Canada, the Tri-State area, and many mining districts in the western states.

He reentered the employ of the St. Louis Smelting and Refining Company in 1916 and has been responsible for many of the important mining and metallurgical developments of this company since that date, having been employed since 1926 in the position he held at the time of his death. In this capacity he traveled extensively in North America and in Europe, and as a result was widely acquainted among mining men.

HARRISON SOUDER, consulting and mining engineer of Ridgewood, N. J., died June 1 of a heart ailment at Duxbury, Mass. He was 67 years old. As general superintendent of the Cornwall, Pa., Ore Bank Company, and as general manager of the Cornwall Division of the Bethlehem Mines Corporation from 1905 to 1927, he installed an elaborate hoisting and loading plant for open pit mining, and developed open pit and underground mining to a capacity of 1,500,000 tons of ore a year.

HARRY CLINTON GOODRICH, chief engineer of the Utah Copper Company and Bingham and Garfield Railway, died April 20 at the age of 70 years. Mr. Goodrich was an outstanding figure in engineering and civic affairs of Salt Lake City for more than 30 years. During his more than 50 years of service he held responsible positions with the Chicago and Northwestern Railway, Denver and Rio Grande Western Railroad, Utah Copper Company and Bingham and Garfield Railway. He had also taken an active part in the affairs of the American Mining Congress, American Institute of Mining and Metallurgical Engineers, American Railway Engineering Association, Utah Society of Engineers, and Western Society of Engineers.

CHARLES K. GLOMAN, well known anthracite mining official, died May 29 in Wilkes-Barre, Pa., at the age of 68. Less than two years ago Mr. Gloman retired after 50 years of service with the Susquehanna Collieries Company. Recently he completed an autobiography in which he recounted the outstanding experiences of his lifetime.

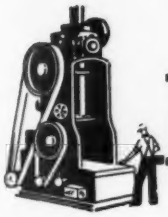
JOHN M. MCFARLANE, well known mining man of Utah, died May 3 in Salt Lake City at the age of 75. For many years Mr. McFarlane was manager of the Utah Sulphur Company, and he was also interested in the early operations of the Silver Reef mine.

FRANK M. FLETCHER, for many years chief engineer in the coal mining department of the Sloss-Sheffield Steel and Iron Company, died in Birmingham, Ala., May 22, at the age of 67.

E. L. BERGER, general superintendent of the Bell and Zoller Mines at Zeigler, Ill., died suddenly May 27 at the age of 54. In charge of operations at Zeigler since 1925, Mr. Berger had been an official of the Bell and Zoller Company for 20 years.

DR. FRANCIS B. LANEY, head of the department of geology at the University of Idaho, died recently at the age of 63.

ARTHUR P. VAN SCHAICK, vice president of the American Chain and Cable Company, Inc., died June 7 while traveling from New Orleans to Chicago on the Panama Limited. Following a month's vacation at Beaumont, Calif., Mr. Van Schaick was returning with Mrs. Van Schaick to their home at Southport, Conn.

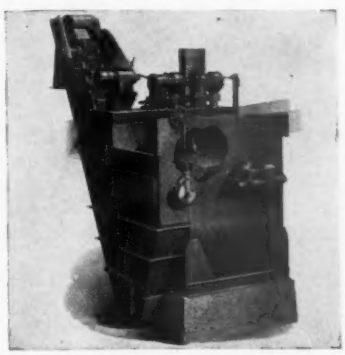


MANUFACTURERS' Forum

Smaller Coal Washery

A new coal washery for the smaller capacities, to be known as the Link-Belt Junior "Baum-Type" coal washery, is being announced by Link-Belt Company. This is the washery that made its first appearance, in the form of a full-size unit, as a part of the Link-Belt exhibit at the American Mining Congress convention in Cincinnati, May 2-6.

The Junior is designed to meet the need for equipment for cleaning sized coal, ⅜ to 6 in., at the rate of 20 to 50 tons per hour. It is a two-cell unit embodying all of the basic features of the Link-Belt Simon-Carves washery, and is recommended for the producer of moderate tonnages, or the operator who now employs tipple preparation and needs to clean one or more additional sizes.



The new unit is covered by a special folder No. 1721, copies of which will be sent to interested readers upon request, addressed to Link-Belt Company, 300 West Pershing Road, Chicago, or the nearest office of the company.

Office Transfer

Brown Co., producer of purified wood celluloses, announces that the executive offices of its tubular products division has been transferred from Portland, Me., to the company's offices in the Graybar Building, 420 Lexington Avenue, New York City.

The products of this division include Bermico fibre pipe for mines. It is claimed that this fibre pipe is immune to the corrosive action of acid mine water. All correspondence and inquiries should be addressed to the new office.

Hand Rotated Stopehamer

Ingersoll-Rand has recently introduced a new hand-rotated Stopehamer known as the "SA-90." This machine embodies several new features of design. The piston is similar in outward appearance to that customarily used in jackhamers and drifters. It is solid except for the water tube hole and combines the advantage of long wearing surfaces of the jackhamer-type piston with the rugged resistance to breakage of the so-called block-type piston.

The throttle valve is a radical departure in rock-drill design. It consists of two circular plates held together by air pressure. This is one of the advantages claimed for the taper-type throttle. At the same time this SA-90 throttle retains the ease of operation of the straight throttle. The large wearing surfaces materially increase the life of this part.

The fronthead is of the shrouded type overlapping the cylinder and increasing the rigidity of the drill at this point. The entire front end of the drill, including front cylinder washer, is equipped with easily and quickly renewable bushings on all wearing surfaces. The new, double opening, direct-flow main valve is claimed to be responsible for the low air consumption and high drilling speed of this stoper. Descriptive literature, Bulletin 2409, may be obtained from Ingersoll-Rand Company, 11 Broadway, New York City, or any of their branch offices.

New Sink-and-Float Separation Process

Concluding a research program begun in 1902, a process for producing standardized high-grade coal from virtually any grade of material from run-of-mine coal to refuse, was recently announced by the E. I. du Pont de Nemours & Company, R. & H. chemicals department, minerals separation division. The process is known as the sink-and-float process, after the physical principle upon which it is based. The use of recently available heavy liquid compounds—halogenated hydrocarbons—as, for example, pentachlorethane and tetrabromethane, the latter being three times as heavy as water, together with the pretreatment with an active agent solution which places a water film around the particles of coal and slate, constitutes the chemical achievement which has rendered the process commercially feasible. Coal and slate, or minerals having different weights for the same volume, can be separated by placing them in a heavy liquid the specific gravity of which is between that of the coal and slate. When this is done, a perfect separation is effected. The slate, being heavier than the liquid, sinks, and the coal, being lighter,

floats. This is exactly the same thing that happens when a mixture of wood blocks and pebbles is put in a bucket of water. The wood blocks float and the pebbles sink.

The heavy liquids used in the process do not change in specific gravity while in use so that the quality of coal produced in any breaker or cleaning plant is not dependent on the human element. Moreover, as these liquids do not mix with water and a film of an aqueous solution of active agent consisting of tannic acid or starch acetate is placed on the particles before separation, the heavy liquids can be recovered from the coal and slate by sprays of water and reused. Thus, the loss of heavy liquid is very low and the process inexpensive to operate.

The company's engineers say that the new process should put the coal industry, and particularly the anthracite producers, in a better competitive position, since the product would not only be considerably improved and standardized but operating economies should result. The following specific improvements in quality are claimed for coal cleaned by the sink-and-float process: A more uniform product; complete elimination of slate; a reduction in ash and in ashpit loss of fuel; elimination of clinker troubles; an increase in heating value per ton of fuel; more even combustion; easier control of combustion; less dust and dirt in fuel; less odors from gas and smoke. Another advantage is the reduction of sulphur fumes which harm vegetation and are damaging to property.

Temporary Mine Set-Screw Bond

The Ohio Brass Company, Mansfield, Ohio, announces the development of a new temporary bond, especially designed for room work where frequent installations and reclamations must be made. This bond, known as the O-B Temporary Mine

Set-Screw Bond, is provided with terminals that embrace the base of the rail. A quick turn of the wrench on the heavy set-screw locks the terminal to the rail mechanically and electrically. A 2/0 copper strand joins the terminals.

It is expected that this device will encourage correct return circuit construction in temporary room work by facilitating installation and reclamation.

Calyx Core Drills

A new 42-page catalog on the complete line of Calyx Core drills has recently been issued by the manufacturer, Ingersoll-Rand Company. This type of drill is designed for boring holes in rock and concrete in sizes from 2¼ to 72 in. in diameter, and depths of 2,500 ft.

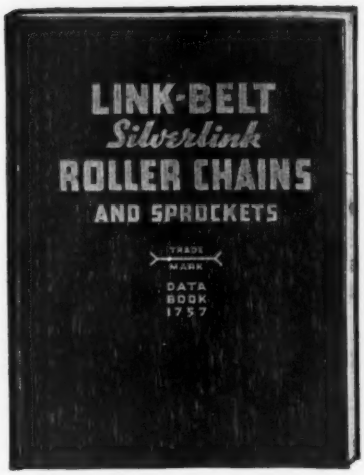
Seventeen models for all classes of service, including laboratory testing, highway testing, mine ventilation shaft drilling, foundation testing, well drilling, elevator-plunger-hole drilling, mineral exploration, oil structure exploration, waterfront construction, and wire-saw equipment-shaft drilling in quarries. Ten pages are devoted to pictorial representation of some of these applications in all parts of the world.

Detailed description of derricks, engines, pumps, drill heads, water swivels, cutters and bits as well as other tools are contained in the catalog, No. 9501-A, copies of which may be obtained from Ingersoll-Rand Company, 11 Broadway, New York City, or any of their branch offices.

Roller Chain Data Book

Announcement is made by Link-Belt Company, Indianapolis, of the completion of an outstanding new data book No. 1757 on its Silverlink roller chain and sprockets for drives and conveyor uses—a book of 174 pages of practical information, application pictures, and engineering data, including many new chains and features not hitherto published.

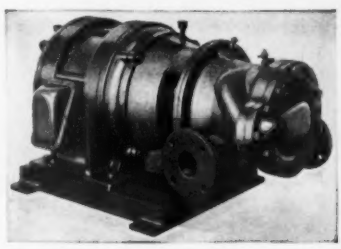
This book covers Silverlink roller chains of manufacturers' (A. S. A.) standard sizes, nonstandard sizes, and



"heavy sizes." Included also are multiple-width roller drive chains, with ultimate strengths ranging up to 460,000 lb. The "heavy sizes" have the same general appearance as the manufacturers' standard sizes, excepting for their thicker side bars and their greater over-all width. These heavy-size chains have been developed for extra-heavy work, such as the grueling service encountered on power transmission jobs in oil-well drilling work. A copy of the new book will be sent to anyone having occasion to select, order, use or maintain equipment of this character. The request should be made on business letterhead, and may be addressed to Link-Belt Company, 519 North Holmes Avenue, Indianapolis, Ind., or to the nearest office of the company.

New Two Stage "SSUnit" Type Centrifugal Pump

Allis - Chalmers Manufacturing Company, centrifugal pump division, Milwaukee, Wis., has supplemented its complete line of single-stage "SSUnit" type pumps by adding a 2½ x 1½-in.



two-stage "SSUnit" type pump good for heads up to 525 ft. at 3,550 revolutions. This pump has an efficient

capacity range of from 50 to 100 g.p.m. against heads of from 300 to 500 ft. It is bolted to the motor frame by a splashproof connection piece, the impellers being mounted on the special motor shaft extension, and the motor bearings also being the pump bearings like in their usual "SSUnit" construction.

Available with motors of from 10 to 30 hp. of the standard squirrel-cage type, splashproof or explosion-proof types, the pump operates with unusual smoothness, and the efficiency holds up well over a wide range. The standard pump has cast-iron casing and cover, and is bronze fitted. The impellers are placed back to back, providing axial balance with the suction impeller next to the motor and the discharge passage from the first-stage impeller cast integral with the main casting body and communicating with a passage in the cover leading to the inlet of the second-stage impeller. This design permits the cover to be taken off, and the inside parts of the pump to be taken out without disconnecting the suction and discharge piping. Descriptive leaflet 2314 may be obtained from their nearest district office.

Dual-Disc Respirator

A new dual-disc respirator for protection against Type A, or nuisance dusts, which employs unusually inexpensive throw-away filters, has just been developed in the industrial hygiene laboratory of Willson Products,

Inc., 278 Thorn Street, Reading, Pa. This respirator, designated as No. 750, bears Approval No. 2119 of the United States Bureau of Mines and is the eighth Willson respirator to be officially approved by the Federal Government.

Inexpensive filters are essential in many occupations, particularly wet operations. Inasmuch as only one filter is needed for each holder, and either side of the filter may face outwardly, the wearer has no difficulty in making filter changes when needed and has assured protection. The dual-disc filters provide 28 sq. in. of filtering surface, offering the advantage of very little resistance to breathing.

The manufacturer will be pleased to furnish complete information and prices upon request.

New Blasting Caps

Atlas Manasite blasting caps and electric blasting caps are announced by Atlas Powder Company as representing a real advance in safety for all users of explosives. The company points out that no detonator should properly be called "safe," as it is intended to set off explosives. The new Manasite detonators, however, substantially increase the margin of safety in handling explosives. This new and exclusive development is the result of several years of research by Atlas laboratories.

The new detonators contain a new initiating compound known chemically as hexanitromannite, a compound much less sensitive to impact and friction than detonating compounds commonly used. Full detonating power and other advantages are maintained. Extensive field tests have already proven the excellent performance and increased safety of the new blasting caps, both types of which are now in production.

Diesel Sales Managers of General Motors

Appointment of George T. Mahaney and James D. Platt as eastern and western retail sales managers, respectively, of the Diesel engine division, General Motors Sales Corporation, was announced recently by William J. Davidson, general sales manager. The two, whose territories will be divided roughly by an imaginary line extending from Mobile, Ala., northward through Chicago and Milwaukee, will maintain their offices at the headquarters of the new Diesel division in Cleveland.

Both men are college graduates. Mr. Mahaney attended Gettysburg College, at Gettysburg, Pa., receiving his degree in 1922; while Mr. Platt was graduated from the Sheffield Scientific School of Yale University in 1924.

Standards Department Formed By General Electric

To better coordinate activities in the development and application of standards both within the company and without, General Electric has formed a new standards department. This organization will work with the various local, national, and international associations and agencies interested in standards and codes and will also promote the development of standards for use in the company's engineering and manufacturing department. The new department will be headed by L. F. Adams, who will serve as manager and assistant to Vice President E. O. Shreve. Associated with Mr. Adams will be E. B. Paxton, E. R. Anderson, H. W. Samson, and H. W. Robb.

The formation of the standards department centers in one organization the work formerly done by smaller groups throughout the various General Electric plants. At the same time, however, the several standardizing committees already established by the company will continue to function in the development and design of apparatus in their respective lines.

Removal Notice

The Duff - Norton Manufacturing Company, with general offices in Pittsburgh, Pa., announced the removal on April 20 of their New York sales offices from 250 Park Avenue, to 3411 Empire State Building. The new telephone is Lackawanna 4-0544.

$85,000 for New Ideas

General Electric Company employes during 1937 received nearly $85,000 for new ideas submitted through the company's suggestion system. During the year almost 37,000 suggestions were made by workers, and more than 12,000 were adopted. During the past 11 years nearly $600,000 has been paid out to employes for new ideas adopted for use.

Air and Gas Compressor

One of the most interesting new applications of the modern Sullivan WN-112 air and gas compressor is the installation illustrated herewith. For this application, where the maximum output of the compressor is required intermittently and the continuous demand is light, Sullivan engineers devised an interesting selective electrical regulation which automatically controls the compressor and its air output in the most economical manner. This control responds to the rate of air

usage, "sampling" taking place each time the compressor unloads.

When the maximum capacity is required, the compressor motor, which is a built-in synchronous type, runs continuously and the compressor is "loaded" or "unloaded" to maintain the air pressure between 98 and 100 lb. When the compressor unloads and the sampling feature indicates that the rate of air usage is low, the motor stops and the unit does not start again until the air pressure drops a predetermined amount—usually 10 lb.

The adjustable pressure differential permits holding the desired terminal pressure to close limits during peak periods and allows the motor to shut down for a reasonable period when the need for air is light.

CATALOGS and BULLETINS

• BLOWERS. *Roots Connersville Blower Corp.*, Connersville, Ind. Bulletin 21 B 19 (superseding 21 B 17) gives details concerning operating principles, construction, accessory equipment, and specifications for the Victor-Acme Rotary Positive Blowers, used for maintaining pressures or vacuums. 8 pages.

• COMPRESSORS. *Sullivan Machinery Co.*, Michigan City, Ind. Bulletin A-12-A is a revised edition of a booklet on single-stage horizontal compressors, Class WG-7. These compressors are built for heavy duty service, are single-cylinder double-acting type with Timken double-row main bearings, replaceable cylinder liners and force-feed cylinder lubrication.

• CONCENTRATING AND WASHING TABLES. *The Deister Concentrator Co.*, Fort Wayne, Ind. Bulletin 23-B is an informative and attractively illustrated booklet describing the salient points of the Diagonal-Deck Deister-Overstrom Table, which is used extensively in recovery of minerals from their ores, preparation of coal, the cleaning of sand or gravel, the recovery of values from slags and drosses, or any other of the multiplicity of uses to which tables are put. 20 pages.

• CRUSHERS. *Traylor Engineering and Manufacturing Co.*, Allentown, Pa. Bulletin 1105 describes in detail the specifications and uses of the Traylor Type H Blake Jaw Crusher, including generous instructions for the assembly, erection, lubrication, operation and repair of this equipment. 16 pages.

• EARTH HANDLING. *Caterpillar Tractor Company*, Peoria, Ill. Book entitled "Roads, Canals and Embankments with 'Caterpillar' Equipment," a very informative volume of 182 pages, is a clear exposition of some of the more common uses of Caterpillar track-type tractors and road machinery, including some allied equipment designed for use with Caterpillar-built tractors. Amounting to a fairly thorough guide of road building methods and equipment, only a limited number of copies are available, and these will be sold for 50 cents per volume.

• ELECTRICAL CONTROLS. *Westinghouse Elec. & Mfg. Co.*, East Pittsburgh, Pa. Catalog section 31-200 gives the application, operation, construction and outstanding features of the company's Silverstat regulators designed for the automatic voltage control of small A-C and D-C generators. 12 pages.

Price list 11-200 describes De-Ion nonreversing line starters, designed for application where overall dimensions are not limited and where wiring room must be exceptionally large. 2 pages.

• ELECTRICAL EQUIPMENT. *General Electric Company*, Schenectady, N. Y. Following new publications: 432C on direct-current generators and exciters; 841H on AC magnetic switch; 1283A on form-operated master switches; 1297E on electric cable-reel equipment; 1437C on gear-motors; 1542C on Type B DC motors; 1607B on DC generators and exciters; 1929A on 21 low speed drives modernized with gear-motors; 2003B on use of the automatic oil circuit reclosers; 2170A on directional distance relays; 2234B on manual motor-starting switch; 2426A on outdoor oil-flask circuit breakers; 2571B on reconditioning flooded electric equipment; 2625 on brake-screw locking device for mine and haulage locomotives; 2714 on wound-rotor AC crane motors; 2742 on pyranol capacitors; 2823 on commercial testing instruments; and 2889 on magnetic motor-starting switches.

Booklet "When You Can Measure" is an attractive, beautifully printed publication describing in pictures and in words the story of how instruments are designed, constructed and tested by the General Electric engineers and scientists. 32 pages.

• GAS MASKS. *Mine Safety Appliances Co.*, Pittsburgh, Pa. Bulletin ED-3 describes MSA industrial masks and canisters in detail. 6 pages.

• INDUSTRIAL SERVICE. *Koppers Company*, Pittsburgh, Pa. "Koppers Year Book—1938" is a most attractive and informative booklet describing the general industrial service rendered by this far flung company, presenting factual data concerning its operations during the year 1937, and detailed reports of Koppers divisions, subsidiaries and eastern gas and fuel associates. 36 pages, including a double-page chart showing the corporate organizations, and another showing the location of the company's properties.

• LIGHTING. *Westinghouse Elec. & Mfg. Co.*, East Pittsburgh, Pa. New addition of book "Artificial Light and Its Applications" provides a ready source of up-to-the-minute facts for the illuminating engineer. The new edition of this handy volume is larger and much more comprehensive than previous issues. 258 pages. Available from the company at 75 cents per copy.

• LOADING MACHINES. *Goodman Manufacturing Company*, Chicago, Ill. Bulletin L-382 presents the Goodman "360," a track type loading machine built to operate in both low and high coal. This machine has all the valuable features of the "250" model, plus many improvements. Overall height of the machine is such that it can readily be operated in 4-foot coal, and delivers exceptionally high tonnage. Features of the machine and its operation are explained fully in this illustrated bulletin. 4 pages.

• LOCOMOTIVES. *Goodman Manufacturing Company*, Chicago, Ill. Bulletin H-377 presents the Goodman line of haulage locomotives which completely covers the haulage field from the small single motor locomotives through the larger 2-motor units, to the big 3-motor type. The bulletin is profusely illustrated, and there is engineering information and specifications. 28 pages.

• METERS. *Roots Connersville Blower Corp.*, Connersville, Ind. Bulletin 40B 12 presents construction features, advantages, specifications, tests and uses of the company's rotary displacement meters. 16 pages.

• PLUMBING. *Crane Company*, 836 So. Michigan Avenue, Chicago, Ill. Bulletin AD-1231 describes the company's plumbing and heating equipment for use in industrial and commercial buildings, covering by word and pictures such subjects as the importance of proper sanitation in industry, dangers of back siphonage, typical installations, lavatories, faucets and fixtures for wash sinks, showers, drinking fountains, etc. 32 pages.

• PUMPS. *Morris Machine Works*, Baldwinsville, N. Y. Bulletin 168 describes centrifugal pump designs for handling clear water, corrosive mixtures, and various kinds of abrasive materials. Also describes hydraulic dredges which have proven successful in recovering coal from the bottom of rivers, ponds, etc. 20 pages.

• SCREENS. *Deister Machine Co.*, 1933 E. Wayne St., Fort Wayne, Ind. Bulletin 26 describes in detail the general construction and operation of the Deister Plat-O Vibrating Screen. 12 pages.

• THICKENERS AND CLARIFIERS. *Hardinge Company*, York, Pa. Bulletin 31B presents a description of and uses for (including metallurgical, chemical, and industrial) Hardinge thickeners and clarifiers. 4 pages.

• VALVES. *Crane Company*, 836 So. Michigan Avenue, Chicago, Ill. Booklet AD-1264 is an 8-page pamphlet describing the Crane plug disc globe and angle valves, listing the essential characteristics of each member of the Crane plug disc family.

Quick welding repairs with Tobin Bronze

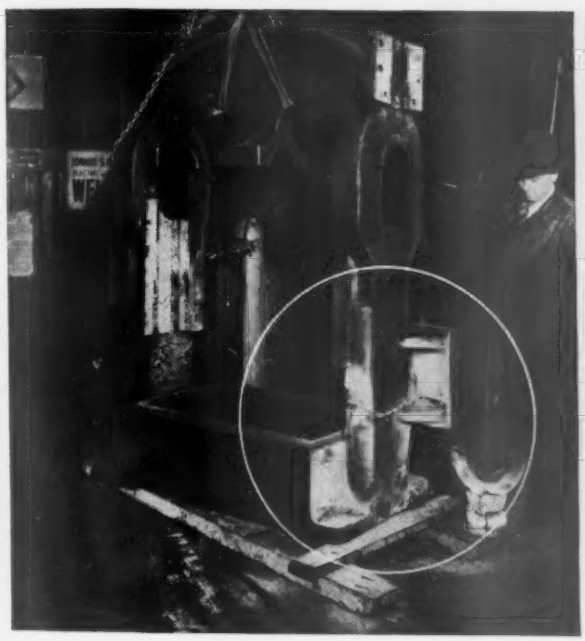
Save weeks of delay for industry

FROM every part of the country come stories of the money and time saved for plant owners by welders who use Tobin Bronze. These stories confirm the verdict of experienced welders that Tobin Bronze is a *better welding rod.*

For castings of such size and shape that furnace pre-heating is impossible, Tobin Bronze is often the *only answer.* Usually the fractured area is veed out; then *locally* pre-heated. Tobin Bronze makes an effective weld under conditions where ordinary cast-iron welding is impracticable.

• • •

Make your place known as headquarters for Tobin Bronze welding. This time-tried Anaconda product makes highly satisfactory repairs at low cost. Each rod bears the trademark "Tobin Bronze Reg. U. S. Pat. Off." Look for it to make sure you are getting *genuine* Tobin Bronze. 37361



Another "busy season" breakdown repaired with Tobin Bronze

This press used in the manufacture of a glider-type porch swing broke at the peak of the manufacturing season. Here it is, repaired with Tobin Bronze and back at work again. The Hebeler Welding Company of Buffalo did this job. "We can't say enough good things about Tobin Bronze," says E. S. Hebeler.

ANACONDA

Anaconda Welding Rods

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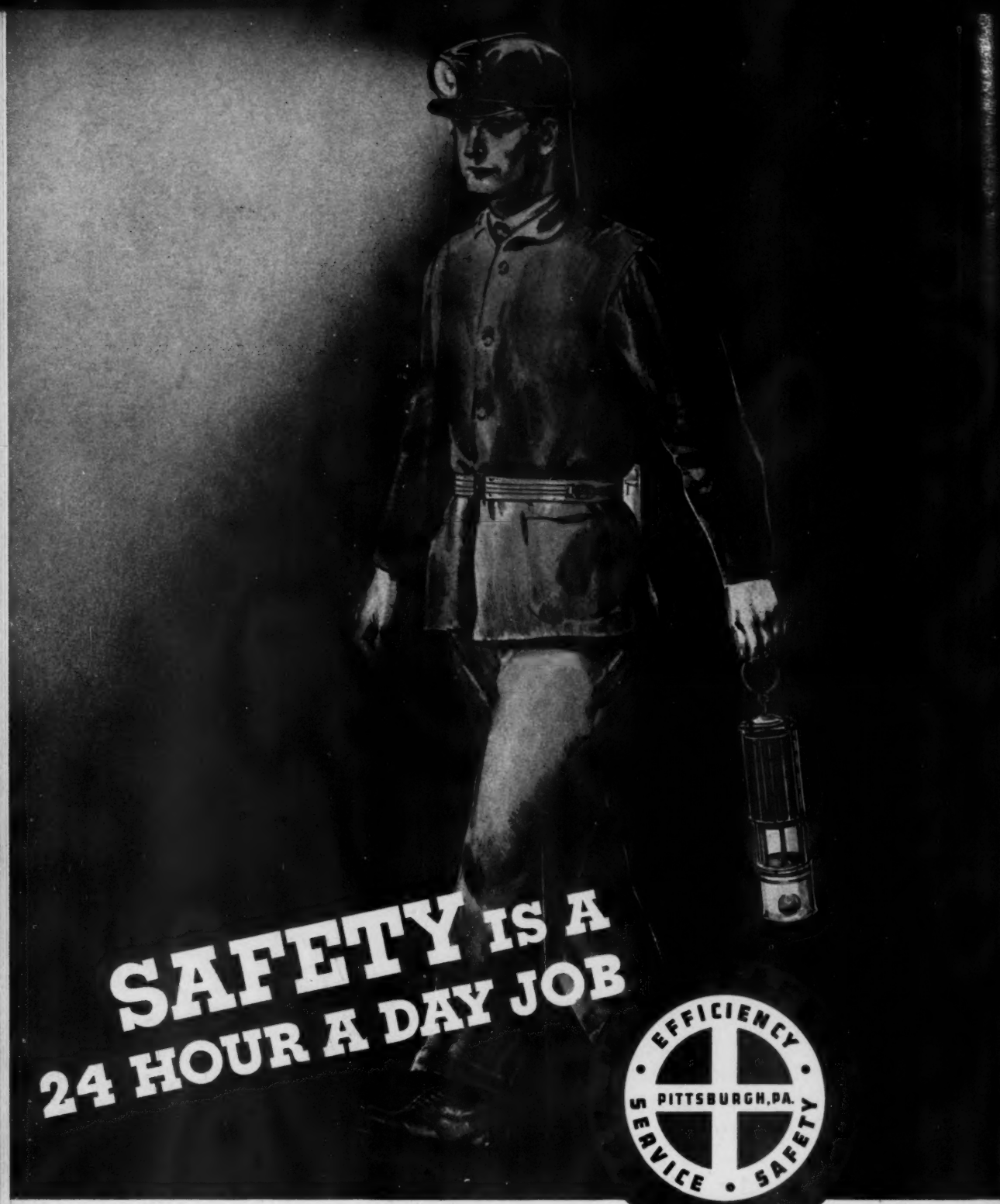

There can be no "let-up" in the vigilance required to reduce mining accidents—it must be continuous to be successful. That the mining industry is evermore watchful in nullifying hazards is proven by its continually bettering safety record.

On the equipment side of the picture you will find at M.S.A. a relentlessly unceasing search for new and improved mine safety material; constant care in the manufacturing and testing of the many standard products bearing our name, and a splendid plant safety record. Safety is in truth a "24-Hour Job" for the industry and suppliers alike—and we are proud of our share in the work!

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